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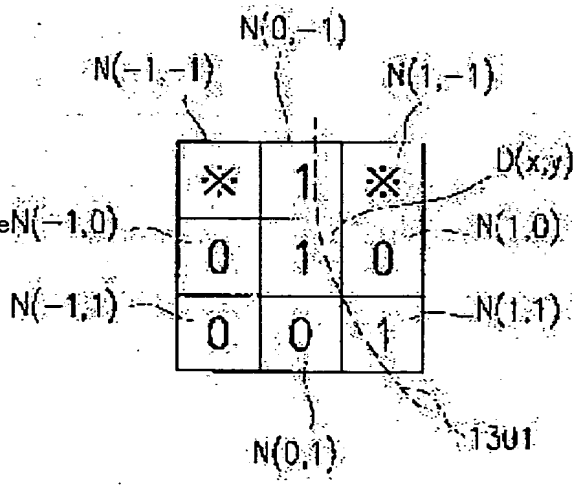
(54) GRAPHIC DISPLAY DEVICE, CHARACTER DISPLAY DEVICE, DISPLAY METHOD, RECORDING MEDIUM AND PROGRAM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a graphic display device which can display a graphic expressed by bit map data with high definition and requires a reduced data amount to display the graphic.

SOLUTION: The graphic display device for displaying a graphic represented by binary bit map data 1a includes a display device 3 having plural sub-pixels, and a control part 20 for controlling the display device. The plural sub-pixels form plural groups, and each of the groups includes prescribed plural pieces of sub-pixels. The control part 20 makes each bit of the bit map data correspond to one of the groups, and controls the sub-pixels included in the one of the groups based on the information on the peripheral bits of the bits D(x, y) made to correspond to the one of the groups, and thereby displays the graphic on the display device 3.



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CLAIMS

[Claim(s)]
[Claim 1] The display device which is a graphic display for displaying the graphic form expressed by binary bit map data, and has two or more subpixel, It has the control section which controls said display device. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said control section Each bit of said bit map data is matched with one of said two or more of the groups. The graphic display which displays said graphic form on said display device by controlling the subpixel contained in one of said two or more of the groups based on the information on the surrounding bit of the bit matched with one of said two or more of the groups.
[Claim 2] Said control section is a graphic display according to claim 1 which defines the basic part of said graphic form displayed on said display device based on the information on the surrounding bit of the bit matched with one of said the groups.
[Claim 3] Said control section is a graphic display according to claim 1 which controls the subpixel contained in one of said two or more of the pixels based on the information on the continuity of the bit of said circumference.
[Claim 4] One color element which corresponds among at least one color element is beforehand assigned to each of two or more of said subpixel. The strength of each of at least one color element It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said control section The color element level of at least one specific subpixel corresponding to the basic part of the graphic form displayed on said display device is set as the color element level according to max or max. The graphic display according to claim 1 which sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said graphic form as color element level other than the color element level according to said max or max.
[Claim 5] Said control section is a graphic display according to claim 4 which adjusts the line breadth of said graphic form displayed on said display device by controlling the number of the subpixel corresponding to the basic part of said graphic form.
[Claim 6] Said control section is a graphic display according to claim 4 which adjusts the line breadth of said graphic form displayed on said display device by controlling the color element level of the subpixel which adjoins at least one specific subpixel corresponding to the basic part of said graphic form.
[Claim 7] It is the graphic display according to claim 4 to which each of two or more of said subpixel is controlled by changing said color element level into an intensity level based on a predetermined table, and said control section generates said predetermined table according to the property of said display device.
[Claim 8] Said control section is a graphic display according to claim 7 which compares the property of the display device used as criteria with the property of said display device, and generates said predetermined table according to the difference.
[Claim 9] The display device which is a character display device for displaying the alphabetic character with which it was expressed by binary bit map data, and has two or more subpixel, It has the control

section which controls said display device. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said control section Each bit of said bit map data is matched with one of said two or more of the groups. It responds to the additional information assigned to at least one of the bits of said bit map data. (1) It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (2) Character display which changes whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled based on the pattern specified by said additional information.

[Claim 10] It has the storing section which stores the basic partial data which define the basic parts of the display device which has two or more subpixel, the control section which controls said display device, and an alphabetic character per subpixel. One color element which corresponds among two or more color elements is beforehand assigned to each of two or more of said subpixel. The strength of each of two or more of said color elements It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said control section Read said basic partial data from said storing section, and it is based on said basic partial data. The color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character is set as predetermined color element level. Character display which sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character as color element level other than said predetermined color element level.

[Claim 11] It is the graphic form method of presentation which displays the graphic form expressed with the display device which has two or more subpixel by binary bit map data. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said approach (a) The step which matches each bit of said bit map data with one of said two or more of the groups, (b) The graphic form method of presentation which includes the step which displays said graphic form on said display device by controlling the subpixel contained in one of said two or more of the groups based on the information on the surrounding bit of the bit matched with one of said two or more of the groups.

[Claim 12] It is the character representation approach for displaying the alphabetic character expressed with the display device which has two or more subpixel by binary bit map data. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said approach (a) The step at which said control section matches each bit of said bit map data with one of said two or more of the groups, (b) It responds to the additional information assigned to at least one of the bits of said bit map data. It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. (b-1) [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (b-2) The character representation approach which includes the step which changes whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled based on the pattern specified by said additional information.

[Claim 13] It is the character representation approach which displays an alphabetic character on the display device which has two or more subpixel. One color element which corresponds among two or more color elements is beforehand assigned to each of two or more of said subpixel. The strength of each of two or more of said color elements It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said approach (a) The step which reads from storage the basic partial data which define the basic part of an alphabetic character per subpixel, (b) The step which sets the color element level of at least one specific subpixel

corresponding to the basic part of said alphabetic character as predetermined color element level based on said basic partial data, (c) The character representation approach which includes the step which sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character as color element level other than said predetermined color element level.

[Claim 14] It is the record medium in which reading [information display / equipped with the display device which has two or more subpixel] is possible. Said record medium The program which performs a graphic form display process is recorded on said information display. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said graphic form display processing (a) The step which matches each bit of binary bit map data with each of two or more of said groups, (b) Record medium which includes the step which displays a graphic form on said display device by controlling the subpixel contained in each of two or more of said groups based on the information on the surrounding bit of the bit matched with each of two or more of said groups.

[Claim 15] It is the record medium in which reading [information display / equipped with the display device which has two or more subpixel] is possible. Said record medium The program which performs character representation processing is recorded on said information display. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said character representation processing (a) The step which matches each bit of binary bit map data with one of said two or more of the groups, (b) It responds to the additional information assigned to at least one of the bits of said bit map data. It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. (b-1) [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (b-2) The record medium which includes the step which changes whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled based on the pattern specified by said additional information.

[Claim 16] It is the record medium in which reading [information display / equipped with the display device which has two or more subpixel, and the storing section which stores the basic partial data which define the basic part of an alphabetic character per subpixel] is possible. Said record medium stores in said information display the program which performs character representation processing. One color element which corresponds among two or more color elements is beforehand assigned to each of two or more of said subpixel. The strength of each of two or more of said color elements It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said character representation processing (a) The step which reads the basic partial data which define the basic part of an alphabetic character per subpixel from said storing section, (b) The step which sets the color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character as predetermined color element level based on said basic partial data, (c) Record medium which includes the step which sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character as color element level other than said predetermined color element level.

[Claim 17] It is the program which makes the information display equipped with the display device which has two or more subpixel perform a graphic form display process. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said graphic form display processing (a) The step which matches each bit of binary bit map data with each of two or more of said groups, (b) Program which includes the step which displays a graphic form on said display device by controlling the subpixel contained in each of two or more of said groups based on the information on the surrounding bit of the bit matched with each of two or more of said groups.

[Claim 18] It is the program which makes the information display equipped with the display device which has two or more subpixel perform character representation processing. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said character representation processing (a) The step which matches each bit of binary bit map data with one of said two or more of the groups, (b) It responds to the additional information assigned to at least one of said each of the bit. It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. (b-1) [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (b-2) The program which includes the step which changes whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled based on the pattern specified by said additional information.

[Claim 19] It is the program which makes the information display equipped with the display device which has two or more subpixel, and the storing section which stores the basic partial data which define the basic part of an alphabetic character per subpixel perform character representation processing. One color element which corresponds among two or more color elements is beforehand assigned to each of two or more of said subpixel. The strength of each of two or more of said color elements It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said character representation processing (a) The step which reads the basic partial data which define the basic part of an alphabetic character per subpixel, (b) The step which sets the color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character as predetermined color element level based on said basic partial data, (c) Program which includes the step which sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character as color element level other than said predetermined color element level.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the graphic display, the graphic form method of presentation, and the record medium which can display a graphic form with high definition using the display device in which color display is possible.

[0002]

[Description of the Prior Art] As a technique which displays graphic forms, such as an alphabetic character and a pictorial symbol, on an indicating equipment, the technique which displays the bit map

data corresponding to binary [monochrome] on a pixel measure is known, for example. In this technique, 1 dot which constitutes a graphic form is matched with 1 pixel of a display, and the pixel matched with the black dot (part which forms the profile and the interior of a graphic form) is black, and it is expressed, and the pixel matched with the white dot is white, and is expressed.

[0003] Moreover, the technique currently indicated by JP,3-201788,A is known as an amelioration technique of the technique which displays the conventional bit map data on a pixel measure. According to this amelioration conventional technique, in the electrochromatic display which has the subpixel corresponding to three color elements, R (red), G (green), and B (blue), the arrangement location of a black field can be adjusted by 1/3-pixel unit, and the slanting line contained in a graphic form can display finely.

[0004]

[Problem(s) to be Solved by the Invention] Drawing 39 A shows the example which displayed the alphabetic character of "A" of the alphabet on the 5 pixel x9 pixel screen 900 with the technique which displays the bit map data corresponding to the conventional monochrome binary one on a pixel measure. In drawing 39 A, the pixel which is black as for the rectangle to which hatching was performed, and is displayed is shown, and the pixel which is white as for the rectangle of void and is displayed is shown.

[0005] Drawing 39 B shows the bit map data 904 of "A" of the alphabet displayed on the screen 900. The bit shown by "1" shown in drawing 39 B corresponds to the black part of a graphic form, and the bit shown by "0" corresponds to the white part of a graphic form.

[0006] Since according to this display technique a big jaggy occurs in the slash of "A" of the alphabet as shown in drawing 39 A, it is not visible to a slash smooth to human being's eyes. Thus, the technique which displays the bit map data corresponding to binary [conventional / monochrome] on a pixel measure can adjust the arrangement location of a black part only by 1-pixel unit. For this reason, a jaggy occurs in the slash and curve of an element which constitute an alphabetic character, and it is not visible to an alphabetic character beautiful to human being's eyes. When displaying an alphabetic character especially using a small number of dots, a jaggy is seen notably.

[0007] Drawing 40 A shows the example which displayed "A" of the alphabet on the screen 910 of a electrochromatic display with the technique currently indicated by JP,3-201788,A as an amelioration technique of the technique which displays the conventional bit map data on a pixel measure.

[0008] The screen 910 has two or more pixels 912, and each of two or more pixels 912 contains the subpixel 914R, 914G, and 914B arranged in the longitudinal direction. Subpixel 914R, 914G, and 914B supports three color elements, R (red), G (green), and B (blue), respectively.

[0009] A black field is expressed as this amelioration conventional technique by preparing the binary bit map data which constitutes an alphabetic character for every plane of R, G, and B, and using the set of three adjoining subpixel as an astigmatism LGT. Each plane means the set of the subpixel corresponding to each color element of R, G, and B here. (R, G, B) and (G, B, R) (B, R, G) the sequence of a throat are sufficient as the set of this 3 subpixel. For this reason, the arrangement location of the black field expressed with the set of 3 subpixel can be adjusted by 1/3-pixel unit, and the slash contained in an alphabetic character can display finely. For example, rather than the slash contained in "A" of the alphabet as which the slash contained in "A" of the alphabet displayed on drawing 40 A is displayed on drawing 39 A, there are few jaggies and it is displayed finely.

[0010] However, according to this amelioration conventional technique, the amount of data required in order to display the alphabetic character of the same size increases, and there is a fault that memory is needed 3 times compared with the technique which displays the conventional bit map data on a pixel measure. It is because it is necessary to prepare the binary bit map data which constitutes an alphabetic character to each plane of R, G, and B.

[0011] Drawing 40 B shows the bit map data 916 based on this amelioration conventional technique. The bit map data 916 consist of bit map data 916R about the plane of R, bit map data 916G about the plane of G, and bit map data 916B about the plane of B. Thus, as compared with the bit map data 904 (drawing

39 B) in the technique in which the bit map data 916 display the conventional bit map data on a pixel measure, the amount of data has increased 3 times.
[0012] furthermore, the array sequence of the subpixel which is used as an astigmatism LGT according to the amelioration conventional technique expressed above -- (R, G, B) -- it not being fixed and with the field (white field) of the subpixel considered as burning [and / (B R, G) / (G B, R)] On a boundary with the field (black field) of the subpixel used as an astigmatism LGT, since color mixture was inadequate, there was a fault that a color noise was conspicuous. Furthermore, since the DS of bit map data differed from the DS of the bit map data used widely conventionally, there was a fault that it was difficult to apply to the information display used from the former widely.
[0013] This invention aims at the amount of data required in order to be able to display the graphic form expressed by bit map data with high definition and to display a graphic form offering few graphic displays, the graphic form method of presentation, a record medium, and a program.
[0014] Other objects of this invention are that the high definition and amount of data required in order to be able to display on high definition and to display an alphabetic character offers little character display, the character representation approach, a record medium, and a program for the alphabetic character with which it is expressed by bit map data.
[0015] The object of further others of this invention does not have a color noise in an alphabetic character, and are highly minute and offering the character display which can be displayed on high definition, the character representation approach, a record medium, and a program.
[0016]
[Means for Solving the Problem] The display device which the graphic display of this invention is a graphic display for displaying the graphic form expressed by binary bit map data, and has two or more subpixel, It has the control section which controls said display device. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said control section Each bit of said bit map data is matched with one of said two or more of the groups. Said graphic form is displayed on said display device by controlling the subpixel contained in one of said two or more of the groups based on the information on the surrounding bit of the bit matched with one of said two or more of the groups. Thereby, the above-mentioned object is attained.
[0017] Said control section may define the basic part of said graphic form displayed on said display device based on the information on the surrounding bit of the bit matched with one of said the groups.
[0018] Said control section may control the subpixel contained in one of said two or more of the pixels based on the information on the continuity of the bit of said circumference.
[0019] One color element which corresponds among at least one color element is beforehand assigned to each of two or more of said subpixel. The strength of each of at least one color element It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said control section The color element level of at least one specific subpixel corresponding to the basic part of the graphic form displayed on said display device is set as the color element level according to max or max. The color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said graphic form may be set as color element level other than the color element level according to said max or max.
[0020] Said control section may adjust the line breadth of said graphic form displayed on said display device by controlling the number of the subpixel corresponding to the basic part of said graphic form.
[0021] Said control section may adjust the line breadth of said graphic form displayed on said display device by controlling the color element level of the subpixel which adjoins at least one specific subpixel corresponding to the basic part of said graphic form.
[0022] Each of two or more of said subpixel is controlled by changing said color element level into an intensity level based on a predetermined table, and said control section may generate said predetermined table according to the property of said display device.

[0023] Said control section compares the property of the display device used as criteria with the property of said display device, and may generate said predetermined table according to the difference.
[0024] The display device which the character display device of this invention is a character display device for displaying the alphabetic character with which it was expressed by binary bit map data, and has two or more subpixel, It has the control section which controls said display device. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said control section Each bit of said bit map data is matched with one of said two or more of the groups. It responds to the additional information assigned to at least one of the bits of said bit map data. (1) It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (2) It changes whether based on the pattern specified by said additional information, the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled. Thereby, the above-mentioned object is attained.
[0025] The display device with which other character display devices of this invention have two or more subpixel, It has the storing section which stores the basic partial data which define the basic parts of a control section and an alphabetic character which control said display device per subpixel. One color element which corresponds among two or more color elements is beforehand assigned to each of two or more of said subpixel. The strength of each of two or more of said color elements It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said control section Read said basic partial data from said storing section, and it is based on said basic partial data. The color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character is set as predetermined color element level. The color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character is set as color element level other than said predetermined color element level. Thereby, the above-mentioned object is attained.
[0026] The graphic form method of presentation of this invention is the graphic form method of presentation which displays the graphic form expressed with the display device which has two or more subpixel by binary bit map data. Said two or more subpixel forms two or more groups. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said approach (a) The step which matches each bit of said bit map data with one of said two or more of the groups, (b) The step which displays said graphic form on said display device is included by controlling the subpixel contained in one of said two or more of the groups based on the information on the surrounding bit of the bit matched with one of said two or more of the groups. Thereby, the above-mentioned object is attained.
[0027] The character representation approach of this invention is the character representation approach for displaying the alphabetic character expressed with the display device which has two or more subpixel by binary bit map data. Said two or more subpixel forms two or more groups. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said approach (a) The step at which said control section matches each bit of said bit map data with one of said two or more of the groups, (b) It responds to the additional information assigned to at least one of the bits of said bit map data. It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. (b-1) [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (b-2) The step which changes whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled based on the pattern specified by said additional information is included. Thereby, the above-mentioned object is attained.
[0028] The character representation approach of ** of this invention is the character representation approach which displays an alphabetic character on the display device which has two or more subpixel.

One color element which corresponds among two or more color elements is beforehand assigned to each of two or more of said subpixel. The strength of each of two or more of said color elements It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said approach (a) The step which reads from storage the basic partial data which define the basic part of an alphabetic character per subpixel, (b) The step which sets the color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character as predetermined color element level based on said basic partial data, (c) The step which sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character as color element level other than said predetermined color element level is included. Thereby, the above-mentioned object is attained.

[0029] The record medium of this invention is a record medium in which reading [information display / equipped with the display device which has two or more subpixel] is possible. Said record medium The program which performs a graphic form display process is recorded on said information display. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said graphic form display processing (a) The step which matches each bit of binary bit map data with each of two or more of said groups, (b) The step which displays a graphic form on said display device is included by controlling the subpixel contained in each of two or more of said groups based on the information on the surrounding bit of the bit matched with each of two or more of said groups. Thereby, the above-mentioned object is attained.

[0030] Other record media of this invention are record media in which reading [information display / equipped with the display device which has two or more subpixel] is possible. Said record medium The program which performs character representation processing is recorded on said information display. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said character representation processing (a) The step which matches each bit of binary bit map data with one of said two or more of the groups, (b) It responds to the additional information assigned to at least one of the bits of said bit map data. It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. (b-1) [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (b-2) The step which changes whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled based on the pattern specified by said additional information is included. Thereby, the above-mentioned object is attained.

[0031] The display device with which other record media of this invention have two or more subpixel, It is the record medium in which reading [information display / equipped with the storing section which stores the basic partial data which define the basic part of an alphabetic character per subpixel] is possible. Said record medium The program which performs character representation processing is stored in said information display. One color element which corresponds among two or more color elements is beforehand assigned to each of two or more of said subpixel. The strength of each of two or more of said color elements It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said character representation processing (a) The step which reads the basic partial data which define the basic part of an alphabetic character per subpixel from said storing section, (b) The step which sets the color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character as predetermined color element level based on said basic partial data, (c) The step which sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character as color element level other than said predetermined color element level is included. Thereby, the above-mentioned object is attained.

[0032] The program of this invention is a program which makes the information display equipped with the display device which has two or more subpixel perform a graphic form display process. Said two or

more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said graphic form display processing (a) The step which matches each bit of binary bit map data with each of two or more of said groups, (b) The step which displays a graphic form on said display device is included by controlling the subpixel contained in each of two or more of said groups based on the information on the surrounding bit of the bit matched with each of two or more of said groups. Thereby, the above-mentioned object is attained.

[0033] Other programs of this invention are programs which make the information display equipped with the display device which has two or more subpixel perform character representation processing. Said two or more subpixel Two or more groups are formed. Each of two or more of said groups The subpixel of two or more numbers defined beforehand is included. Said character representation processing (a) The step which matches each bit of binary bit map data with one of said two or more of the groups, (b) It responds to the additional information assigned to at least one of said each of the bit. It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. (b-1) [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (b-2) The step which changes whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled based on the pattern specified by said additional information is included. Thereby, the above-mentioned object is attained.

[0034] The display device with which other programs of this invention have two or more subpixel, It is the program which makes the information display equipped with the storing section which stores the basic partial data which define the basic part of an alphabetic character per subpixel perform character representation processing. One color element which corresponds among two or more color elements is beforehand assigned to each of two or more of said subpixel. The strength of each of two or more of said color elements It is gradually expressed by two or more color element level. Each of two or more of said subpixel It has one of said two or more color element level. Said character representation processing (a) The step which reads the basic partial data which define the basic part of an alphabetic character per subpixel, (b) The step which sets the color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character as predetermined color element level based on said basic partial data, (c) The step which sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character as color element level other than said predetermined color element level is included. Thereby, the above-mentioned object is attained.

[0035] Hereafter, an operation is explained.

[0036] According to this invention, the subpixel contained in a group in each bit of the bit map data showing a graphic form based on the information on the surrounding bit of the bit matched with one of matching and the groups by one of the groups who consist of two or more subpixel of the number of arbitration is controlled independently gradually. Although the resolution which bit map data have is equivalent to a group's size, the resolution as which a graphic form is displayed is equivalent to the size of subpixel. Therefore, a graphic form can be displayed with high definition in resolution higher than the resolution which the bit map data of a graphic form have. Moreover, the structure of bit map data is bit map data binary [the / as the dot font used conventionally / same], and there is little amount of data required in order to display a graphic form, and it ends.

[0037] Moreover, according to this invention, it responds to the additional information assigned to at least one of each of the bit of the bit map data showing an alphabetic character. (1) It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (2) It is changed whether based on the pattern specified by said additional information, the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled. About the part displayed in

the configuration which is not desirable when subpixel is controlled among alphabetic characters based on the information on a surrounding bit, subpixel is controlled based on the pattern specified by additional information. Thereby, there is little high definition and amount of data required in order to be able to display on high definition and to display an alphabetic character, and it ends the alphabetic character with which it is expressed by bit map data.

[0038] Moreover, according to this invention, based on said basic partial data, the color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character is set as predetermined color element level. The color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character is set as color element level other than said predetermined color element level. Since each strength of two or more color elements is gradually expressed by two or more color element level, it can change the color element level between adjoining subpixel gradually. Thereby, it can control that a color noise occurs. Since basic partial data define the basic part of an alphabetic character per subpixel, they can display an alphabetic character on highly minute and high definition.

[0039]

[Embodiment of the Invention] First, the display principle of the graphic form by this invention is explained. The display principle of this graphic form is common to the gestalt of all operations mentioned later. In addition, with a graphic form, an alphabetic character and a pictorial symbol are included in this description. When a graphic form is defined as a set of a dot, the two-dimensional array of the information on each dot (for example, is it a white dot or is a black dot?) is called bit map data. Moreover, especially the bit map data of an alphabetic character are called a dot font. Therefore, the "bit map data" referred to in this description contains a dot font.

[0040] Drawing 1 shows the screen 400 of the usable display device 3 (drawing 8 A, drawing 8 B, drawing 8 C, and drawing 8 D) typically to the graphic display of this invention. The display device 3 has two or more pixels 12 arranged in the direction of X, and the direction of Y. Each of two or more pixels 12 has two or more subpixel arranged in the direction of X. In the example shown in drawing 1 R> 1, one pixel 12 has three subpixel 14R, 14G, and 14B.

[0041] Subpixel 14R is beforehand assigned to the color element R so that R (red) may be colored. Subpixel 14G are beforehand assigned to the color element G so that G (green) may be colored. Subpixel 14B is beforehand assigned to the color element B so that B (blue) may be colored.

[0042] The brightness of Subpixel 14R, 14G, and 14B is expressed by the value of 0-255. It is possible to display about 16,700,000 (= 256x256x256) color by taking either of the values of 0-255 of Subpixel 14R, 14G, and 14B which show an intensity level, respectively.

[0043] Each subpixel contained in the pixel which consists of subpixel of (R, G, B) at the pixel only based on the information on matching and its bit (information on whether it is "1" or it is "0") in 1 bit of bit map data was controlled by the conventional technique which displays the bit map data mentioned above on a pixel measure at ON or OFF.

[0044] Moreover, only based on the information on matching and its bit, subpixel was controlled for 1 bit of bit map data also by the amelioration conventional technique indicated by JP,3-201788,A mentioned above at ON or OFF to subpixel.

[0045] On the other hand, 1 bit of bit map data is matched with a pixel, and each subpixel contained in the pixel is controlled by this invention in consideration of the information on the bit around the bit. Moreover, each subpixel is gradually controlled by ON or two or more level which are not off independently.

[0046] Thus, the false thing displayed that it is black (namely, there is no color noise) and with high definition (in namely, high resolution) becomes possible not only in the profile of a graphic form but in the graphic form itself by controlling independently two or more color elements (R, G, B) corresponding to the subpixel 14R, 14G, and 14B contained in one pixel 12, respectively, and controlling them appropriately gradually. Here, although "false black" is not strictly black in color study, it means that it

looks black to human being's eyes.

[0047] Moreover, the structure of bit map data is the same as that of the bit map data used in the technique which displays the conventional bit map data by the pixel measure. For this reason, there is an advantage that there are few amounts of memory required since bit map data are stored, and they end, and also there is an advantage of being easily applicable to the information display currently used from the former.

[0048] In addition, this invention is not limited when displaying a black graphic form. It is also possible to display the graphic form of an achromatic color using the display principle of this invention. For example, also when displaying a gray graphic form using the display principle of this invention, the effectiveness mentioned above and the same effectiveness are acquired. What is necessary is just to change the relation of the color element level and the intensity level which are defined in the brightness table 92 shown in drawing 5 so that the color element level 7-0 may be equivalent to intensity levels 128-255 in displaying a gray graphic form. Furthermore, the graphic form which the color attached can be displayed by actuation of a brightness table.

[0049] Drawing 2 shows the example which displayed the slash on the 6 pixel x12 pixel screen 400 of a display device 3. The color element level of Subpixel 14R, 14G, and 14B is controlled by the example shown in drawing 2 by four steps of level 3 - level 0. In drawing 2 , as for the rectangle corresponding to level 3, an intensity level shows the subpixel of 0, as for the rectangle corresponding to level 2, an intensity level shows the subpixel of 80, as for the rectangle corresponding to level 1, an intensity level shows the subpixel of 180, and, as for the rectangle corresponding to level 0, an intensity level shows the subpixel of 255.

[0050] Here, the color element level of the subpixel corresponding to the basic part of a graphic form is set as level 3 (the greatest color element level). The color element level of the subpixel which adjoins the subpixel corresponding to the basic part of a graphic form in the direction of X is set as level 2 or level 1. A basic part is a part equivalent to the heart of a graphic form.

[0051] Drawing 3 shows the example which displayed the slash on the screen 400 of a display device 3 more thinly than the slash shown in drawing 2 . Such a display is attained by making the size (namely, size of the part corresponding to level 3) of the basic part of a graphic form into 1 subpixel from 2 subpixel.

[0052] Drawing 4 shows the example which displayed the slash on the screen 400 of a display device 3 more thickly than the slash shown in drawing 2 . Such a display is attained by making the size (namely, size of the part corresponding to level 3) of the basic part of a graphic form into 3 subpixel from 2 subpixel.

[0053] Thus, it becomes possible by adjusting the size of the basic part of a graphic form in the unit of subpixel to control the size of an alphabetic character by the finer unit compared with the former.

[0054] In the example shown in drawing 2 - drawing 4 , the color element level of subpixel was four steps of level 0 - level 3. By increasing the number of color element REBERU ** of subpixel, it cannot be conspicuous with human being's eyes and colors other than the black currently colored the graphic form can be carried out.

[0055] Drawing 5 shows the brightness table 92 which defines the relation between the color element level (level 7 - level 0) of subpixel, and the intensity level of subpixel. By storing the brightness table 92 in memory, the color element level of subpixel is easily convertible for an intensity level. On the brightness table 92, eight steps of color element level (level 7 - level 0) of subpixel is mostly assigned to intensity levels 0-255 at equal intervals.

[0056] Drawing 6 shows the brightness table 94 which defines the relation between the color element level (level 7 - level 0) of subpixel, and the intensity level of subpixel. On the brightness table 94, the intensity level corresponding to level 7 - level 4 inclines toward the intensity-level 0 side among the color element level of subpixel, and the intensity level corresponding to level 3 - level 0 inclines toward the intensity-level 255 side among the color element level of subpixel. By defining the brightness table

94, as shown in drawing 6 , the size of the line contained in a graphic form can be seemingly displayed thinly as compared with the case where the brightness table 92 shown in drawing 5 is used.
[0057] Drawing 7 shows the brightness table 96 which defines the relation between the color element level (level 7 – level 0) of subpixel, and the intensity level of subpixel. The brightness table 96 is suitably used, when a display device 3 is an electrochromatic display display device. By using the brightness table 96, when the intensity level of the subpixel of the color element B is low, the brightness of the subpixel of the color element B can amend the actual thing perceived more darkly. Thus, by using the brightness table which suited the display property of a display device 3, it cannot be [colors other than the black currently colored the graphic form] conspicuous, and they can be used as human being's eyes.
[0058] In addition, as a display device 3, the electrochromatic display display device of a stripe mold may be used, for example. Or the electrochromatic display display device of a delta mold may be used as a display device 3. Even when using the electrochromatic display display device of a delta mold, the same effectiveness as the electrochromatic display device of a stripe mold can be acquired by controlling each subpixel of R, G, and B corresponding to one pixel according to an individual. The liquid crystal display device of an others and reflective mold and a rear pro mold that in a personal computer etc. used as an electrochromatic display display device may be used. [many] [device / of a transparency mold / liquid crystal display] However, a display device 3 is not limited to an electrochromatic display display device. The electrochromatic display (the so-called XY matrix display equipment) of the arbitration which has two or more pixels arranged in the direction of X and the direction of Y as a display device 3 may be used.
[0059] Furthermore, the number of the subpixel contained in one pixel 12 is not limited to 3. One or more subpixel arranged in the predetermined direction may be contained in one pixel 12. For example, when it expresses a color using the color element of N individual, the subpixel of N individual may be contained in one pixel 12.
[0060] Furthermore, it is not limited in order of the array the order of an array of Subpixel 14R, 14G, and 14B is also indicated to be to drawing 1 . For example, subpixel may arrange in order of B, G, and R along the direction of X. Furthermore, it is not limited in the direction in which the array direction of Subpixel 14R, 14G, and 14B is also shown in drawing 1 . For example, Subpixel 14R, 14G, and 14B may arrange along the direction of arbitration.
[0061] Furthermore, a color element applicable to this invention is not limited to R (red), G (green), and B (blue). For example, C (cyanogen), Y (yellow), and M (MAZENDA) can also be used as a color element.
[0062] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.
[0063] (Gestalt 1 of operation) Drawing 8 A shows the configuration of graphic-display 1a of the gestalt 1 of operation of this invention. Graphic-display 1a may be a personal computer. As a personal computer, the computer of the type of arbitration, such as a desktop mold or a laptop type, may be used. Or graphic-display 1a may be a word processor.
[0064] Furthermore, graphic-display 1a may be the information display of arbitration, such as electronic equipment and information machines and equipment, equipped with the display device in which color display is possible. For example, graphic-display 1a may be electronic equipment equipped with the electrochromatic display display device, the Personal Digital Assistant which is a pocket information tool, a portable telephone containing PHS, communication equipment, such as general telephone/FAX, etc.
[0065] Graphic-display 1a contains the display device 3 in which color display is possible, and the control section 20 which controls independently two or more color elements corresponding to two or more subpixel contained in a display device 3, respectively. The display device 3, the input device 7, and the auxiliary storage unit 40 are connected to the control section 20.
[0066] The input device 7 is used in order to input the graphic form which should be displayed on a display device 3. Bit map data 5a stored in the auxiliary storage unit 40 is sufficient as the bit map data showing a graphic form, and bit map data 25a inputted through the input device 7 is sufficient as them. When the graphic form which should be displayed on a display device 3 is decided beforehand, bit map

data 5a stored in the auxiliary storage unit 40 may be used. Bit map data 5a is the dot font of an alphabetic character. When displaying an alphabetic character on a display device 3, the text data 26 containing a character code or a character size is inputted into a control section 20 through the input device 7. From bit map data 5a (dot font) stored in the auxiliary storage unit 40, a control section 20 searches the data of the alphabetic character which should be displayed on a display device 3. In this case, as for the input device 7, a keyboard etc. may be used. When graphic-display 1a is a cellular phone, text data 26 may be inputted using a numerical keypad or a jog dial.

[0067] Moreover, when the bit map data of the graphic form which should be displayed on a display device 3 are not stored in the auxiliary storage unit 40, bit map data 25a is inputted into a control section 20 through the input device 7. In this case, as an input device 7, a scanner, a mouse, etc. may be used suitably. An auxiliary storage unit 40 does not have bit map data 5a, but all the bit map data containing a dot font may be inputted through the input device 7.

[0068] Moreover, text data 26 and bit map data 25a may be inputted into a control section 20 through a communication line. In this case, as an input device 7, the interface circuitry to communication lines, such as a modem, may be used. In this case, graphic-display 1a is able to display the document received with the electronic mail according to the graphic form method of presentation of this invention, for example.

[0069] A control section 20 contains CPU2 and main memory 4.

[0070] CPU2 performs display-program 41a stored in the auxiliary storage unit 40 while controlling and supervising the whole graphic-display 1a.

[0071] Main memory 4 stores temporarily data required to perform the data for displaying on data and the display device 3 which were inputted from the input device 7, and display-program 41a. Main memory 4 is accessed by CPU2.

[0072] By performing graphic display program 41a based on various kinds of data stored in main memory 4, CPU2 controls the subpixel of a display device 3, and displays a graphic form on a display device 3. The timing as which a graphic form is displayed on a display device 3 is controlled by CPU2.

[0073] The data 5 required in order to perform display-program 41a and display-program 41a are stored in the auxiliary storage unit 40. Data 5 contain bit map data 5a showing the configuration of a graphic form, amendment pattern table 5b to which color element level was gradually changed in order to control a color noise, and brightness table 5c for changing color element level into an intensity level.

[0074] 1 dot which bit map data 5a and bit map data 25a which an input device receives are binary data, and constitutes a graphic form shall be expressed with 1 bit.

[0075] As brightness table 5c, the brightness brightness table [brightness] 92 (drawing 5), 94 (drawing 6), or 96 (drawing 7) may be used, for example. The storage of the type of the arbitration as an auxiliary storage unit 40 which can store display-program 41a and data 5 may be used. In an auxiliary storage unit 40, the record medium of arbitration may be used as a record medium which stores display-program 41a and data 5. For example, record media, such as a hard disk, CD-ROM, MO, a floppy (trademark) disk, MD and DVD, an IC card, and an optical card, may be used suitably.

[0076] In addition, display-program 41a and data 5 are not limited to being stored in the record medium in an auxiliary storage unit 40. For example, display-program 41a and data 5 may be stored in main memory 4, and may be stored in ROM (not shown). ROMs may be a mask ROM, EPROM and EEPROM, a flash ROM, etc. In the case of this ROM method, the variation of various processings is easily realizable only by exchanging that ROM. A ROM method may be applied suitable for a terminal unit, a portable telephone, etc. of for example, a pocket mold.

[0077] The whole or part may download display-program 41a and data 5 to graphic-display 1a via the communication line of arbitration.

[0078] Display-program 41b (drawing 8 B) mentioned later, display-program 41c (drawing 8 C), display-program B 6a (drawing 8 D) and brightness table generator 6b (drawing 8 D) as well as display-program 41a may be treated.

[0079] Drawing 9 shows the amendment pattern table 2060 as an example of amendment pattern table 5b (drawing 8 A) stored in an auxiliary storage unit 40. The amendment pattern table 2060 defines the amendment pattern 1. The amendment pattern 1 shows that is it Mukai and the color element level of the subpixel arranged near the subpixel corresponding to the basic part of a graphic form is set to a side far from the side near the basic part of a graphic form in order of "5", "2", and "1." It is written as "an amendment pattern (5, 2, 1)" for explanation of such an amendment pattern. Thus, the amendment pattern 1 is used in order to set up the color element level of the subpixel arranged near the subpixel corresponding to the basic part of a graphic form.

[0080] in addition, an amendment pattern -- the number of the near subpixel which has color element level set up is not limited to 3. An amendment pattern can set up the color element level of the near subpixel of the number of one or more arbitration.

[0081] Drawing 10 shows the procedure of display-program 41a. Display-program 41a is performed by CPU2. Hereafter, the procedure of display-program 41a is explained for every step.

[0082] Step S1: The graphic form which should be displayed on a display device 3 is specified. This assignment is performed by inputting text data 26 or bit map data 25a into a control unit 20 through the input device 7, as mentioned above with reference to drawing 8 A.

[0083] Step S2: The bit map data of the graphic form specified at step S1 are stored in main memory 4. This bit map data is bit map data 25a inputted through bit map data 5a or the input device 7 stored in the auxiliary storage unit 40.

[0084] Step S3: The judgment of whether the bit is "1" is performed about each bit which constitutes bit map data. If it is "Yes", processing will progress to step S4. In that, processing progresses to step S7 by "No."

[0085] Step S4: The array pattern of "1"/"0" of the bit near the bit which observes is investigated.

[0086] Step S5: The bit which observes is matched with one of the pixels. This matching is performed by basing on which location on the screen 400 (drawing 1) of a display device 3 a graphic form is displayed. For example, when displaying a graphic form on the upper left corner of the screen 400, the bit located in the upper left corner of bit map data is matched with the pixel located in the upper left corner of the screen 400 among two or more pixels 12 contained in the screen 400. The bit which similarly adjoins the right-hand side of the bit located in the upper left corner of bit map data is matched with the pixel which adjoins the right-hand side of the pixel located in the upper left corner of the screen 400.

[0087] Step S6: According to the array pattern of a nearby bit, the subpixel (subpixel corresponding to the basic part of a graphic form) of a basic part is defined among the subpixel contained in the pixel corresponding to the bit to observe. The definition of the subpixel of this basic part is performed based on a predetermined basic partial definition rule. A basic partial definition rule is later mentioned with reference to drawing 13 A, drawing 13 B - drawing 16 A, and drawing 16 B.

[0088] Step S7: It is judged about all the bits that constitute bit map data whether processing to step S3 - step S6 was completed. If it is "Yes", processing will progress to step S8. In that, processing returns to step S3 by "No."

[0089] Step S8: The color element level of the subpixel defined by step S6 as a basic part is set as the greatest color element level. For example, when the color element level of subpixel is expressed in eight steps of level 7 - level 0, the color element level of the subpixel defined as a basic part is set as level 7.

[0090] Step S9: The color element level of the subpixel arranged near the subpixel defined as a basic part is set to either level 6 - the level 0. Setting out of such color element level is performed using amendment pattern table 5b stored in the auxiliary storage unit 40.

[0091] Step S10: The color element level of subpixel is changed into an intensity level. Such conversion is performed using brightness table 5c stored in the auxiliary storage unit 40.

[0092] Step S11: The brightness data in which the intensity level of subpixel is shown are transmitted to a display device 3. Thereby, the intensity level of a display device 3 is controlled per subpixel.

[0093] Drawing 11 shows some bit map data showing a graphic form. D (x y) is a bit currently observed. The bit D (x+a, y+b) near the D (x y) is expressed as N (a, b). The bits N (−1, −1), N (0 −1), N (1 −1), N (1 −0), N (1 0), N (1 −1), N (0 1), and N (1 1) near [which adjoins Bit D (x y) in length, width, or the direction of slant] the eight pieces are shown in drawing 11 . The bit near [these] the eight pieces is called "about 8." in addition, the target bit map data are binary in this invention, and bit map data are constituted -- a ** bit has the value of "1" or "0", respectively. The bit which has the value of "1" expresses the black part of a graphic form, and the bit which has the value of "0" expresses the white part of a graphic form. N (a, b) and D (x y) have the value of "1" or "0."

[0094] Drawing 12 shows a part of screen of a display device 3. P (x y) is one pixel on the screen. The bit D (x y) shown in drawing 11 is matched with Pixel P (x y) in case the graphic form expressed by bit map data is displayed on a display device 3. Pixel P (x y) contains three subpixel C (3x, y), C (3x+1, y), and C (3x+2, y). When D (x y) has the value of "1", the subpixel of a basic part is defined by the basic partial definition rule among three subpixel C (3x, y), C (3x+1, y), and C (3x+2, y). When D (x y) has the value of "0", no three subpixel is defined as a basic part.

[0095] According to the basic partial definition rule, it is determined by the conditions of the array of "0" and "1" of the bit N (a, b) near the bit D (x y) matched with Pixel P (x y) whether each of three subpixel contained in Pixel P (x y) is defined as a basic part. A basic partial definition rule is explained below. In the following explanation, Bit D (x y) shall have the value of "1."

[0096] Drawing 13 A shows about eight example of the bit D (x y) currently observed in bit map data. If it expresses that Bit N (a, b) has the value of "1" as N(a, b) = 1, it is shown that drawing 13 A is N(0 −1) =N(1 1) =1, and is N(1 0) =N(0 1) =N(1 −1) =N(1 −0) =0. In addition, the bits N (−1, −1) and N (1 −1) shown in drawing 13 A by "*" have the any value of "0" or "1." In following drawing 14 A – drawing 16 A, the bit shown by "*" shall have the any value of "0" or "1" similarly. These bits are bits which are not taken into consideration in a basic partial definition rule.

[0097] Drawing 13 B shows the subpixel defined by the basic partial definition rule, when it has the value about eight bit of Bit D (x y) is indicated to be to drawing 13 A. The pixel P (x y) on the screen matched with Bit D (x y) contains three subpixel C (3x, y), C (3x+1, y), and C (3x+2, y). It is the subpixel by which the subpixel shown by "1" is defined as drawing 13 B as a basic part among such subpixel, and the subpixel shown by "0" is the subpixel which is not defined as a basic part. That is, Subpixel C (3x+2, y) is defined as a basic part, and Subpixel C (3x, y) and Subpixel C (3x+1, y) are not defined as a basic part.

[0098] The basic partial definition rule explained by drawing 13 A and drawing 13 B can be expressed using logical expression.

[0099] If "A*B" is made into the OR of A and B to logical values A and B and "!A" is made into the logical NOT of A, when it has the value about eight bit of Bit D (x y) is indicated to be to drawing 13 A, the following logical expression (1) is filled.

[0100]

N(0,−1)*!N(−1,0)*!N(1,0)*!N(−1,1)*!
N(0,1)*N(1,1)=1 (1

Moreover, the following formula (2) can express processing in which define Subpixel C (3x+2, y) as a basic part as shown in drawing 13 B, and Subpixel C (3x, y) and Subpixel C (3x+1, y) are not defined as a basic part.

[0101]

C(3x,y)=0,C(3x+1,y)=0,C(3x+2,y)=1 (2)

A basic part is a part equivalent to the heart of a graphic form. When a graphic form is an alphabetic character, a basic part is a part for the center section of the stroke (stroke) included in an alphabetic character. Since the information on a stroke will be lost, a guess must define a basic part by bit map data. A basic part can be guessed based on the information on the bit near the bit D (x y) currently observed, although it cannot guess only from the information on the bit D (x y) currently observed. For example, in the case of the bit map data shown in drawing 13 A, it is surmised that a stroke is a curve

passing through the field corresponding to Bits N (0 −1), D (x y), and N (1 1) (shown to drawing 13 A by the broken line 1301). Since it is thought that such a curve passes through the right-hand side inside the field corresponding to Bit D (x y), the subpixel C (3x+2, y) of the right-hand side included in the pixel P (x y) corresponding to Bit D (x y) (drawing 13 B) is defined as a basic part. A basic part is defined per subpixel. For this reason, the basic part of a graphic form is defined by resolution higher than the bit map data of the graphic form which has the resolution of a pixel measure. For this reason, it becomes possible to display a graphic form with high definition.

[0102] A basic partial definition rule is generated by the guess mentioned above. The generated basic partial definition rule is expressed by the logical expression mentioned above, and it is used in step S6 of the procedure shown in drawing 10 .

[0103] Drawing 14 A shows other about eight examples of the bit D (x y) currently observed in bit map data.

[0104] Drawing 14 B shows the subpixel defined by the basic partial definition rule, when it has the value about eight bit of Bit D (x y) is indicated to be to drawing 14 A. The basic partial definition rule shown by drawing 14 A and drawing 14 B is described as follows using logical expression.

[0105]

C(3x, y) = 1, C(3x+1, y) = 1, and C(3x+2, y) =1 drawing 15 A show about eight example of further others of the bit D (x y) currently observed in bit map data at the time of N(1 −0) *N(1 0) =1.

[0106] Drawing 15 B shows the subpixel defined by the basic partial definition rule, when it has the value about eight bit of Bit D (x y) is indicated to be to drawing 15 A. The basic partial definition rule shown by drawing 15 A and drawing 15 B is described as follows using logical expression.

[0107] N(0 −1) *! N(1 −0) *! At the time of N(1 0) *N(0 1) =1, C(3x, y) = 0, C(3x+1, y) = 1, and C(3x+2, y) =0 drawing 16 A About eight example of further others of the bit D (x y) currently observed in bit map data is shown.

[0108] Drawing 16 B shows the subpixel defined by the basic partial definition rule, when it has the value about eight bit of Bit D (x y) is indicated to be to drawing 16 A. The basic partial definition rule shown by drawing 16 A and drawing 16 B is described as follows using logical expression.

[0109] ! N(−1, −1) *! N(0 −1) *! N(1 −0) *N(1 0) *! N(1, −1) *! At the time of N(0 1) = 1 C(3x, y) = 0, C(3x+1, y) = 1, and C(3x+2, y) = 1 -- by preparing about all "1" of about eight dot of Bit D (x y) which is observing the above basic partial definition rules, or the combination of "0" The basic part of the graphic form which should be displayed on a display device 3 is defined per subpixel.

[0110] Drawing 17 shows all "1" of about eight dot, or the combination of "0." Each rectangle shown in drawing 17 shows the bit D (x y) currently observed and its about eight dot. The interior of a rectangle is divided into nine fields, the black and shown field corresponds to the bit which has the value of "1", and the white and shown field supports the bit which has the value of "0." The rectangle of 256 pieces is shown in drawing 17 . It is because it has the value of "0" or "1", respectively, so the number of combination becomes [of about eight dot] 28= 256 kinds. However, only the same number as the number of these combination is not necessarily required for the number of a basic partial definition rule. As already explained, in drawing 13 A, drawing 14 A, drawing 15 A, and drawing 16 A, the bit shown by "*" is a bit which has the any value of "0" or "1", and is not taken into consideration in a basic partial definition rule. Thus, since the bit which is not taken into consideration may be included in a basic partial definition rule, two or more cases of the combination shown in drawing 17 by one basic partial definition rule can be covered. For example, the basic partial definition rule shown in drawing 13 A and drawing 13 B covers the case shown with a rectangle 1701, a rectangle 1702, a rectangle 1703, and a rectangle 1704 among the combination shown in drawing 17 , respectively. Thus, when a basic partial definition rule may contain the bit which has any value, the number of required basic partial definition rules can be reduced.

[0111] Both the rectangle 1705 and the rectangle 1706 are the mirror images of a rectangle 1701. The basic partial definition rule applied to the case shown with a rectangle 1705 and a rectangle 1706 can be

easily derived from the basic partial definition rule shown in drawing 13 A and drawing 13 B. Moreover, a rectangle 1707 is 180-degree revolution image of a rectangle 1701. It can derive from the basic partial definition rule the basic partial definition rule applied to the case shown with a rectangle 1707 is also indicated to be to drawing 13 A and drawing 13 B easily.

[0112] Moreover, a basic partial definition rule may be described by in the form of logical expression as mentioned above, and may be described as table data.

[0113] In this invention, the dot font used for example, by the conventional technique can be used as bit map data.

[0114] Drawing 18 shows the result of having applied the basic partial definition rule mentioned above to the bit map data (dot font) of "A" of the alphabet shown in drawing 39 B. The field shown in drawing 18 by hatching shows the subpixel defined as a basic part.

[0115] The color element level of the subpixel defined as these basic parts is set as the greatest color element level (color element level 7) by display-program 41a (step 7 of drawing 10). Or the color element level of the subpixel defined as a basic part may be set as the color element level (for example, color element level 6) according to max. Thus, the whole graphic form can be displayed on a thin color by setting the color element level of the subpixel defined as a basic part as the color element level according to max.

[0116] Setting out of the color element level of the subpixel near the subpixel defined as a basic part is performed using amendment pattern table 5b stored in the auxiliary storage unit 40. When the amendment pattern table 2060 shown in drawing 9 as amendment pattern table 5b is used, it explains below how setting out of the color element level of subpixel will be performed soon.

[0117] The amendment pattern table 2060 defines the amendment pattern 1. The color element level of the subpixel 1802 which adjoins the left-hand side of the subpixel 1801 defined as a basic part shown in drawing 18 is set to the color element level 5 corresponding to the train of the "subpixel 1" of the amendment pattern 1, i.e., level. The color element level of subpixel 1803 is set to the color element level 2 corresponding to the train of the "subpixel 2" of the amendment pattern 1, i.e., level. The color element level of subpixel 1804 is set to the color element level corresponding to the train of the "subpixel 3" of the amendment pattern 1, i.e., level 1. Color element level is similarly set up about the subpixel 1812, 1813, and 1814 of near on the right-hand side of subpixel 1801. Thus, it can control that a color noise occurs in a part with the large difference of the brightness of adjoining subpixel by changing the color element level of subpixel gradually soon using an amendment pattern.

[0118] Drawing 19 shows the example which set the color element level of the subpixel defined as a basic part shown in drawing 18 as level 7, and set up the color element level of the subpixel near the subpixel defined as a basic part using the amendment pattern table 2060. The figure shown in drawing 19 expresses the color element level set as each subpixel.

[0119] Thus, the color element level of the subpixel which adjoins at least one specific subpixel corresponding to the basic part of a graphic form is controlled.

[0120] The subpixel near the subpixel defined as a basic part may be contained in the pixel other than the pixel in which the subpixel defined as a basic part is contained. In the example shown in drawing 19 , a part of subpixel contained in a pixel 3193 and a pixel 3194 with the another pixel 3192 in which the subpixel 3191 defined as a basic part is contained is set as the color element level 2 or color element level 1 as subpixel near the subpixel 3191.

[0121] The amendment pattern according to various objects besides amendment pattern 1 defined as the amendment pattern table 2060 can be used for an amendment pattern.

[0122] The following shows the variation of an amendment pattern table.

[0123] Drawing 20 shows the amendment pattern table 2170 as a modification of amendment pattern table 5b. The amendment pattern table 2170 defines the amendment pattern 1 - the amendment pattern 5. By using the amendment pattern 1 - the amendment pattern 5 properly according to the line breadth of a graphic form, it becomes possible to adjust the line breadth of a graphic form.

[0124] The line breadth information which shows the line breadth of a graphic form is inputted into a control section 20 from the input device 7 in step S1 of drawing 1010 . What is necessary is to choose one of the amendment pattern 1 of an amendment pattern table – the amendment patterns 5 according to the line breadth information on the inputted graphic form, and just to set up the color element level of the subpixel which adjoins the subpixel defined as a basic part according to the selected amendment pattern in step S9 of drawing 10 . If the amendment pattern 5 is chosen, the line of a graphic form will be thickly displayed rather than the case where the amendment pattern 1 is chosen. Thus, adjustment of line breadth is possible changing an amendment pattern, i.e., by controlling the color element level of the near subpixel of the subpixel defined as a basic part. Adjustment of such line breadth is effective especially when emphasizing and displaying an alphabetic character.

[0125] In addition, adjustment of the line breadth of a graphic form is realizable also by fluctuating the number of the subpixel defined as a basic part.

[0126] Drawing 21 shows the amendment pattern table 2180 as a modification of amendment pattern table 5b. If the graphic form of all sizes is displayed using the same amendment pattern, as for the graphic form of large size, compared with the graphic form of small size, line breadth will look thinly. It can control that the size of the appearance of the line of a graphic form varies according to the size of a graphic form by changing an amendment pattern in accordance with the size of a graphic form.

[0127] When the size of a graphic form is 20 or less dots and the size of a graphic form is 21–32 dots, different amendment patterns 1, 2, and 3 to each in the case of being three in case the size of a graphic form is 33–48 dots are defined by the example shown in drawing 21 . Thus, it can control that the size of the appearance of the line of a graphic form varies by using the amendment pattern suitable for the size of a graphic form. By increasing the number of divisions further in the case of the size of a graphic form, it can control further that the size of the appearance of the line of a graphic form varies. The size of a graphic form is represented with the width of face or the height of a graphic form.

[0128] The amendment pattern of the amendment pattern table 2180 is used in step S9 of drawing 10 .

[0129] Drawing 22 shows the amendment pattern table 2270 as a modification of amendment pattern table 5b. The amendment pattern table 2270 defines the amendment pattern 1 and the amendment pattern 2. The amendment pattern 1 and the amendment pattern 2 are properly used according to the complexity of a graphic form. It can control that the whole graphic form becomes blackish and appears by this in complicated graphic forms (for example, kanji with many stroke counts etc.). The complexity of a graphic form can be judged in the bit map data of a graphic form by asking for the number of the bits which have the value of "1", and a number of a bit of rates which have the value of "0." For example, a number of a bit of rates which have the value of "1" judge with the predetermined graphic form it is [graphic form] above comparatively being a complicated graphic form, and the amendment pattern 2 is applied to such a graphic form. Or complexity of a graphic form may be judged based on arrangement with the bit which has the value of "1", and the bit which has the value of "0."

[0130] The above explanation defined the basic part in the corresponding pixel P (x y) based on the information on about eight bit of Bit D (x y). However, based on the information on bits other than about [D / (x y)] eight, the basic part in the corresponding pixel P (x y) may be defined.

[0131] Thus, step S7 mentioned above with reference to drawing 10 and step S8 – step S11 It is based on the information on whether it is [0] whether the bit of the circumference of the bit D (x y) matched with one pixel P (x y) of two or more pixels 12 (drawing 1) is 1 as a whole. It functions as a step which displays a graphic form on a display device 3 by controlling the subpixel C (3x, y) contained in Pixel P (x y), Subpixel C (3x+1, y), and Subpixel C (3x+2, y).

[0132] Moreover, the subpixel defined as a basic part may be determined according to the inclination of the segment included, for example in a graphic form. Moreover, according to an inclination, an amendment pattern may be used properly. This is explained below. In addition, in the following explanation, the subpixel of R, G, and B which are contained in one pixel shall be arranged horizontally. That is, left–hand side subpixel, the subpixel of middle, and right–hand side subpixel are contained in one

pixel.

[0133] Drawing 23 A shows the bit which has the value of "1" among the bit map data of the graphic form showing the segment of tantheta=1 with the rectangle which performed hatching, and shows the bit which has the value of "0" with the rectangle of void. However, tantheta shows the inclination of the segment included in a graphic form. The inclination of the segment included in a graphic form is called for by detecting the information on the continuity of a bit that it has the value of "1" in the perimeter of the bit to observe.

[0134] Drawing 23 B shows the subpixel defined as a basic part of the graphic form showing the segment of tantheta=1. The subpixel shown in drawing 23 B by "7" (color element level) shows the subpixel defined as a basic part. In the case of tantheta=1, the subpixel of middle is defined as a basic part among the subpixel contained in the pixel matched with the bit which has the value of "1." For example, although subpixel 2321, 2322, and 2323 is contained in the pixel 2312 matched with the bit 2301 which has the value of "1" shown in drawing 23 A, the subpixel 2322 of middle is defined as a basic part among these.

[0135] Drawing 23 C shows the example which set up the color element level of the subpixel near the subpixel defined as a basic part of the graphic form showing the segment of tantheta=1. As shown in drawing 23 C, in the case of tantheta=1, the color element level of nearby subpixel is set up for example, using an amendment pattern (5, 3, 2, 1).

[0136] Drawing 24 A shows the bit which has the value of "1" among the bit map data of the graphic form showing the segment of tantheta=1/3 with the rectangle which performed hatching, and shows the bit which has the value of "0" with the rectangle of void.

[0137] Drawing 24 B shows the subpixel defined as a basic part of the graphic form showing the segment of tantheta=1/3. The subpixel shown in drawing 24 B by "7" (color element level) shows the subpixel defined as a basic part. The inside of the subpixel contained in the pixel which is matched with the bit which has the value of "1", and to observe in the case of tantheta=1/3, When the right-hand side and/or left-hand side which are the bit which the bit in which the subpixel of middle is defined as a basic part and has the value of "1" further is observing are adjoined. The subpixel of right-hand side and/or left-hand side is also defined as a basic part among the subpixel contained in the pixel matched with the bit to observe, respectively. For example, although subpixel 2521, 2522, and 2523 is contained in the pixel 2511 matched with the bit 2501 which has the value of "1" shown in drawing 24 A, among these, the subpixel 2522 of middle is defined as a basic part, and the subpixel 2521 and 2523 of right-hand side and left-hand side is also further defined as a basic part. Moreover, although subpixel 2524, 2525, and 2526 is contained in the pixel 2512 matched with the bit 2502 which has the value of "1", among these, the subpixel 2525 of middle is defined as a basic part, and the right-hand side subpixel 2526 is also further defined as a basic part.

[0138] Drawing 24 C shows the example which set up the color element level of the subpixel near the subpixel defined as a basic part of the graphic form showing the segment of tantheta=1/3. As shown in drawing 24 C, in the case of tantheta=1/3, the color element level of nearby subpixel is set up for example, using an amendment pattern (5, 3, 2, 2, 1, 1). This amendment pattern differs from the amendment pattern (5, 3, 2, 1) which is used in the case of tantheta=1 explained with reference to drawing 23 C. When displaying a straight line on a display device, when the value of tantheta becomes small, generally there is an inclination for a jaggy to become easy to be conspicuous. Thus, by using an amendment pattern properly suitably according to the value of tantheta, even when the value of tantheta is small, it cannot be [a jaggy] conspicuous and it can be used as human being's eyes. That is, it becomes possible to display a straight line smoothly.

[0139] Moreover, when the value of tantheta is larger than 1, it may be appropriate for reverse to change an amendment pattern also in one segment according to the location of the subpixel defined as a basic part. Such a case is explained below.

[0140] Drawing 25 A shows the bit which has the value of "1" among the bit map data of the graphic

form showing the segment of tantheta=2 with the rectangle which performed hatching, and shows the bit which has the value of "0" with the rectangle of void.

[0141] Drawing 25 B shows the subpixel defined as a basic part of the graphic form showing the segment of tantheta=2. The subpixel shown in drawing 25 B by "7" (color element level) shows the subpixel defined as a basic part. The slash shown in drawing 25 A is connected from the lower left of drawing to the upper right. Pixels 2611 and 2612 (drawing 25 B) are matched with the bits 2601 and 2602 (drawing 25 A) which have the value of "1" which adjoins in the two vertical directions, respectively. About the pixel 2611 located in the bottom between these two pixels, the left-hand side subpixel 2633 is defined as a basic part, and the right-hand side subpixel 2634 is defined as a basic part about the pixel 2612 located in an upside. The subpixel 2631-2638 shown in drawing 25 B is the subpixel which did in this way, respectively and was defined as a basic part. The core of the subpixel defined as these basic parts is located in a line with zigzag, without standing in a line on a straight line so that drawing 25 B may show.

[0142] Drawing 25 C shows the example which set up the color element level of the subpixel near the subpixel defined as a basic part of the graphic form showing the segment of tantheta=2. As shown in drawing 25 C, in the case of tantheta=2, the amendment pattern used is changed [near / which were defined as a basic part / near on the right-hand side of subpixel, and near the left-hand side]. That is, an amendment pattern (5, 3, 2, 1) is used [near / 2643 / near 2641 on the right-hand side of subpixel 2633, and / on the left-hand side of subpixel 2634], and an amendment pattern (4, 2, 1) is used [near / 2644 / near 2642 on the left-hand side of subpixel 2633, and / on the right-hand side of subpixel 2634]. Thus, it can control that originate in the list of the zigzag of the core of the subpixel defined as a basic part, and a straight line is perceived by zigzag by changing the amendment pattern used near the left-hand side near right-hand side. That is, it becomes possible to display a straight line smoothly.

[0143] Drawing 26 A shows the bit which has the value of "1" among the bit map data of the graphic form showing the segment of tantheta=4 with the rectangle which performed hatching, and shows the bit which has the value of "0" with the rectangle of void.

[0144] Drawing 26 B shows the subpixel defined as a basic part of the graphic form showing the segment of tantheta=4. The subpixel shown in drawing 26 B by "7" (color element level) shows the subpixel defined as a basic part. The slash shown in drawing 26 A is connected from the lower left of drawing to the upper right. Pixels 2811-2814 (drawing 26 B) are matched with the bits 2801-2804 (drawing 26 A) which have the value of "1" which adjoins in the four vertical directions, respectively. About the pixel 2811 located in the bottom among these four pixels, the left-hand side subpixel 2821 is defined as a basic part, about the pixels 2812 and 2813 located in a center section, the subpixel 2822 and 2823 of middle is defined as a basic part, respectively, and the right-hand side subpixel 2824 is defined as a basic part about the pixel 2814 located in an upside.

[0145] Drawing 26 C shows the example which set up the color element level of the subpixel near the subpixel defined as a basic part of the graphic form showing the segment of tantheta=4. An amendment pattern (4, 2, 1) is used near the both sides of subpixel 2821 and 2824, an amendment pattern (5, 3, 2, 1) is used [near / near on the left-hand side of subpixel 2822, and / on the right-hand side of subpixel 2823], and an amendment pattern (4, 2, 1) is used [near / near on the right-hand side of subpixel 2822, and / on the left-hand side of subpixel 2823]. An amendment pattern (4, 2, 1) is used near the both sides of subpixel 2824 and subpixel 2821.

[0146] A straight line can be smoothly displayed by changing an amendment pattern also in one segment according to the location of the subpixel defined as a basic part as mentioned above.

[0147] According to the approach of controlling subpixel based on the information on the continuity of a bit explained with reference to drawing 23 A, drawing 23 B, drawing 23 C - drawing 26 A, drawing 26 B, and drawing 26 C, it becomes possible to display a straight line on a display device 3 smoothly. Therefore, this approach is effective especially when displaying a graphic form with many straight lines on a display device 3. In addition, processing which defines the subpixel of a basic part based on the

information on the continuity of a bit is performed in step S6 of drawing 10 . Moreover, processing which changes an amendment pattern according to the location of the subpixel defined as a basic part is performed in step S9 of drawing 10 .

[0148] In the example stated above, the bit of the bit map data showing a graphic form was matched with the pixel of the screen. For example, the bit D of drawing 11 (x y) was matched with the pixel P of drawing 12 R> 2 (x y). It can be considered that one pixel is the group of two or more subpixel. For example, it can be considered that Pixel P (x y) is the group who consists of subpixel C (3x, y), C (3x+1, y), and C (3x+2, y). In this invention, although the bit of bit map data is matched with the group of subpixel, this group does not necessarily need to consist of 3 subpixel contained in one pixel. For example, the bit D (x y) shown in drawing 11 may be matched with the group Grp of subpixel shown in drawing 12 . Moreover, the number of the subpixel contained in a group and the number of the subpixel contained in a pixel do not necessarily need to be in agreement, either. For example, even if it is the case where three subpixel is contained in one pixel, the bit of bit map data may be matched with group Grp' which consists of four subpixel. Moreover, it is not limited to arranging the subpixel contained in a group only in the direction of X. For example, subpixel may match the bit of bit map data with the group who arranges in the direction of X, and the direction of Y like group Grp" of the subpixel shown in drawing 12 R> 2. Thus, also when a bit is matched with the group who consists of subpixel of the number of the arbitration which was able to be defined beforehand, this invention can be applied by using the basic partial definition rule according to the number of subpixel and arrangement which are included in a group. Also in the gestalten 2 and 4 of operation mentioned later, it is not limited to matching a bit with a pixel, but can match with the group who consists of subpixel of the number of the arbitration which was able to appoint the bit beforehand.

[0149] Moreover, although each subpixel was explained as what is assigned to two or more color elements, application of this invention is not restricted to this. For example, even when being set up so that each subpixel may express black gradation (gray scale) as white, respectively, the graphic-display technique of this invention can be applied. Even if it is the case where each subpixel is assigned to the single color element (green), for example, G, a graphic form can be displayed with high definition by the shade of the single color element.

[0150] Thus, the subpixel contained in a group based on the information on the surrounding bit of the bit matched with one of matching and the groups by one of the groups of the bit map data showing a graphic form who consist a bit of two or more subpixel of the number of arbitration is controlled by this invention, respectively. There is also little amount of data required in order to be able to display a graphic form with high definition and to display a graphic form by this, and it ends.

[0151] Since a graphic form can be displayed in resolution higher than the resolution which the bit map data which express a graphic form with this invention have, it is effective also when the resolution of bit map data is low. For example, the alphabetic character (namely, small alphabetic character) with which it is expressed by the dot font of the small number of dots can be displayed with high definition. Therefore, especially in information displays, such as a portable telephone containing especially a Personal Digital Assistant and PHS, it is effective. It is because readability falls and is not desirable if the magnitude of a display device has constraint and the alphabetic character displayed on a display device is enlarged in these pocket types of information display.

[0152] As already stated, when displaying an alphabetic character by graphic-display 1a (drawing 8 A) of the gestalt 1 of operation (i.e., when using graphic-display 1a as character display), it is possible to display an alphabetic character with high definition. However, it was rarely checked by experiment of artificers that an alphabetic character may be locally displayed in the configuration which is not desirable.

[0153] Hereafter, graphic-display 1a of the gestalt 1 of operation explains the example as which an alphabetic character is locally displayed in the configuration which is not desirable, referring to drawing 27 A and drawing 27 B.

[0154] Drawing 27 A shows the bit map data 3271 (dot font) showing the configuration of the alphabetic character "**" of the kanji of having a 11 dot x11 dot character size. A part 3273 shows the stroke (the 3rd drawing) of the 3rd of an alphabetic character "**", and a part 3274 shows the stroke (the 5th drawing) of the 5th of an alphabetic character "**."
[0155] Drawing 27 B shows the result of having applied the basic partial definition rule, to the bit map data 3271. The field shown in drawing 27 B by hatching shows the subpixel defined as a basic part by the basic partial definition rule explained with reference to drawing 13 A, drawing 13 B – drawing 16 A, and drawing 16 B.
[0156] In graphic-display 1a of the gestalt 1 of operation, the color element level of the subpixel defined as a basic part shown in drawing 27 B is set as the greatest color element level the same with having explained with reference to drawing 18 and drawing 19 , for example. Moreover, the color element level of the subpixel near the subpixel defined as a basic part is set up using amendment pattern table 5b. Thereby, an alphabetic character "**" is displayed on a display device 3 (drawing 8 A). Therefore, arrangement of the subpixel defined as a basic part shown in drawing 27 B is reflected in the grace of the alphabetic character "**" displayed on a display device 3.
[0157] The part 3272 of drawing 27 B shows the part locally displayed among alphabetic characters "**" in the configuration which is not desirable. The upper bed section of a stroke of the 3rd of the alphabetic character "**" shown in a part 3272 is offset on right-hand side as compared with other parts of the 3rd stroke. When an alphabetic character "**" is displayed on a display device 3 by setting up the color element level of the subpixel near the subpixel of the basic part shown in drawing 27 B using amendment pattern table 5b, the upper bed section (part 3272) of a stroke of the 3rd of an alphabetic character "**" is distorted and displayed on un-wanting, and an alphabetic character "**" is not displayed on high definition.
[0158] Thus, that an alphabetic character "**" is locally displayed in the configuration which is not desirable originates in the 3rd stroke 3273 (drawing 27 A) which has touched mutually, and the 5th stroke 3274 (drawing 27 A) having been dealt with as if they were one continuous stroke by the basic partial definition rule.
[0159] With the gestalt 2 of operation of the following this inventions, by correcting the part of the alphabetic character locally displayed in this way in the configuration which is not desirable explains the character display which can display an alphabetic character on high definition.
[0160] (Gestalt 2 of operation) Drawing 8 B shows the configuration of character display 1b of the gestalt 2 of operation of this invention. In drawing 8 B, the same reference number is given to the same component as the component shown in drawing 8 A, and the explanation is omitted.
[0161] Character display 1b may be a personal computer. As a personal computer, the computer of the type of arbitration, such as a desktop mold or a laptop type, may be used. Or character display 1b may be a word processor.
[0162] Furthermore, character display device 1b may be the information display of arbitration, such as electronic equipment and information machines and equipment, equipped with the display device in which color display is possible. For example, character display device 1b may be electronic equipment equipped with the electrochromatic display display device, the Personal Digital Assistant which is a pocket information tool, a portable telephone containing PHS, communication equipment, such as general telephone/FAX, etc.
[0163] In character display device 1b, bit map data 5a stored in the auxiliary storage unit 40 is the dot font of an alphabetic character. When displaying an alphabetic character on a display device 3, the text data 26 containing a character code or a character size is inputted into a control section 20 through the input device 7. From bit map data 5a (dot font) stored in the auxiliary storage unit 40, a control section 20 searches the data of the alphabetic character which should be displayed on a display device 3. In this case, as for the input device 7, a keyboard etc. may be used. When graphic-display 1b is a cellular phone, text data 26 may be inputted using a numerical keypad or a jog dial.

[0164] Character display 1b is changed to display-program 41of graphic-display 1a (drawing 8 A) a, and has display-program 41b. Character display device 1b contains partial correction data 5e further.
[0165] Partial correction data 5e means whether there is any part of an alphabetic character which is locally displayed in the configuration which is not desirable, or there is nothing, when a basic partial definition rule is applied to a certain alphabetic character. Moreover, it means in which location partial correction data 5e is, when there is still such a part, and how such a part should be corrected in order that the alphabetic character may display on high definition.
[0166] Drawing 28 shows the procedure of display-program 41b. Display-program 41b is performed by CPU2. Hereafter, the procedure of display-program 41b is explained for every step. However, in drawing 28 , the same reference number is given to the same step (step S3 - step S6 and step S8 - step S11) as the step shown in drawing 10 , and the explanation is omitted.
[0167] Step S3801: The alphabetic character which should be displayed on a display device 3 is specified. This assignment is performed by inputting text data 26 into a control unit 20 through the input device 7, as mentioned above for example, with reference to drawing 8 B.
[0168] Step S3802: The number of the bit for correction of partial correction data 5e of the alphabetic character specified at step S3801 is stored in main memory. The structure of partial correction data 5e is later mentioned with reference to drawing 29 - drawing 31 .
[0169] Step S3803: It is judged whether the number of the bit for correction stored in main memory 4 at step S3802 is equal to Nmax. Here, the bit for correction will mean the bit displayed in the configuration which is not desirable, if the basic partial definition rule explained among the bits of the bit map data of an alphabetic character with reference to drawing 13 A, drawing 13 B - drawing 16 A, and drawing 16 B is followed. In the example shown in drawing 27 A, a bit 3275 is equivalent to the bit for correction. Nmax shows the number of all the bits contained in the bit map data of an alphabetic character. Nmax is calculated from the character size specified by text data 26 at step S3801. For example, if the specified character size is 11 dot x11 dot, it is Nmax=11x11=121.
[0170] Step S3804: Bit map data 5a of the alphabetic character specified at step S3801 is stored in main memory 4.
[0171] Step S3805: It is judged about all the bits that constitute bit map data whether processing to step S3 - step S6 was completed. If the judgment in step S3805 is "Yes", processing will progress to step S3860. If the judgment in step S3805 is "No", processing will return to step S3. In addition, in step S3805, the judgment of whether processing to step S3 - step S6 was completed may be performed about all the bits except the bit for correction among all the bits that constitute bit map data.
[0172] When the judgment in step S3805 serves as "Yes", the subpixel of a basic part is defined among the subpixel contained in the pixel corresponding to the bit about all the bits except the bit for correction among the bits which constitute bit map data.
[0173] Step S3860: The subpixel of a basic part is defined based on partial correction data 5e. The detail of step S3860 is later mentioned with reference to drawing 32 . By performing step S3860, the subpixel of a basic part is defined among the subpixel contained in the pixel corresponding to the bit about the bit for correction among the bits which constitute bit map data. Therefore, when activation of step S3860 is completed, the subpixel of a basic part is defined among the subpixel contained in the pixel corresponding to the bit about all the bits that constitute bit map data. [0174] Hereafter, the DS of partial correction data 5e is explained, referring to drawing 29 - drawing 31 . Three kinds of DS can be taken depending on how many partial correction data 5e has a bit for correction among the bits of the Nmax individual contained in the bit map data of an alphabetic character.
[0175] Drawing 29 shows the DS of partial correction data 5e in case the number N of the bit for correction is under Nmax more greatly than 0. Partial correction data 5e contains the alphabetic character number 3301, the number 3302 of the bit for correction, X coordinate 3304 of each bit for correction and Y coordinate 3305, and the basic partial pattern 3306 of the bit for correction. The alphabetic character number 3301 is a character code showing the class of alphabetic character. X

coordinate 3304 and Y coordinate 3305 of the bit for correction express the location of the bit for correction in the inside of the bit map data showing the configuration of the alphabetic character. The basic partial pattern 3306 of the bit for correction shows the subpixel which should be defined as a basic part among the subpixel contained in the pixel, when the bit for correction is matched with one pixel. For example, when central subpixel should be defined as a basic part, including three subpixel (left subpixel, central subpixel, and right subpixel) which one pixel arranges horizontally, the basic partial pattern 3306 may be expressed as (0, 1, 0).

[0176] X coordinate 3304 of the bit for correction and Y coordinate 3305, and N basic partial patterns 3306 of the bit for correction are contained in partial correction data 5e, respectively.

[0177] Thus, partial correction data 5e specifies the bit for correction of N individual, and specifies how the basic part should be defined about the bit for correction.

[0178] Drawing 30 shows the DS of partial correction data 5e when the number N of the bit for correction is equal to 0. In drawing 30 , the same reference number is given to the same element as the element shown in drawing 29 , and the explanation is omitted. When N is 0, X coordinate 3304 of the bit for correction and Y coordinate 3305 which were explained with reference to drawing 29 , and the basic partial pattern 3306 of the bit for correction are not contained in partial correction data 5e.

[0179] Drawing 31 shows the DS of partial correction data 5e when the number N of the bit for correction is equal to Nmax. In drawing 31 , the same reference number is given to the same element as the element shown in drawing 29 , and the explanation is omitted. That N is equal to Nmax shows that all the bits of the Nmax individual contained in the bit map data of an alphabetic character are bits for correction. In this case, it may be abbreviated to X coordinate 3304 and Y coordinate 3305 of the bit for correction which were explained with reference to drawing 29 by defining the array sequence of each bit for correction beforehand. For example, the bit 1 for correction shown in drawing 31 has X coordinate 0 and Y coordinate 0, and the bit 2 for correction can define the array sequence of each bit for correction beforehand so that it may have X coordinate 1 and Y coordinate 0. Therefore, when the value of an X coordinate and a Y coordinate is specified, the basic partial pattern of the bit for correction (n is an integer below or more 1Nmax the n-th bit for correction and here) located in the X coordinate and Y coordinate can be taken out.

[0180] Drawing 32 shows the detailed procedure of processing (step S3860 shown in drawing 28) of defining the subpixel of a basic part based on partial correction data 5e. Hereafter, the procedure shown in drawing 32 is explained for every step.

[0181] Step S602: It is judged whether the number N of the bit for correction is one or more. If the judgment in step S602 is "Yes", processing will progress to step S603. Processing will be ended if the judgment in step S602 is "No." That this judgment is "No" means that partial correction data 5e has the DS shown in drawing 30 . In this case, the processing which defines the subpixel of a basic part based on partial correction data 5e is unnecessary.

[0182] Step S603: It is judged whether the number N of the bit for correction is equal to Nmax. If the judgment in step S603 is "Yes", processing will progress to step S608. That this judgment is "Yes" means that partial correction data 5e has the DS shown in drawing 31 .

[0183] If the judgment in step S603 is "No", processing will progress to step S604. That this judgment is "No" means that partial correction data 5e has the DS shown in drawing 29 .

[0184] Step S X coordinate 3304 (drawing 29) of the 604:n-th bits for correction (the bit n for correction), Y coordinate 3305, and the basic partial pattern 3306 are stored in main memory 4. Here, n is the natural number below or more 1N.

[0185] Step S605: The bit for correction is matched with one of the pixels. This matching is performed like step S5 of the procedure explained with reference to drawing 10 R> 0.

[0186] Step S606: The subpixel of a basic part is defined among the subpixel contained in the pixel corresponding to the bit for correction. The definition of the subpixel of this basic part is performed based on the basic partial pattern 3306 stored in main memory 4 in step S604.

[0187] Step S607: It is judged about all the bits for correction whether processing of step S604 – step S607 was completed. Processing will be ended if the judgment in step S607 is "Yes." If the judgment in step S607 is "No", as for processing, processing of step S604 – step S607 will be repeated by step S604 about return and another bit for correction.
[0188] Step S608: A coordinate value Y is initialized by 0.
[0189] Step S609: A coordinate value X is initialized by 0.
[0190] Step S610: The basic partial pattern 3306 (drawing 31) of the n-th bit for correction in the location of a coordinate value X and a coordinate value Y is stored in main memory 4.
[0191] Step S611: The bit for correction is matched with one of the pixels. This matching is performed like step S605.
[0192] Step S612: The subpixel of a basic part is defined among the subpixel contained in the pixel corresponding to the bit for correction. The definition of the subpixel of this basic part is performed based on the basic partial pattern 3306 stored in main memory 4 in step S610.
[0193] Step S611: Only 1 makes a coordinate value X increase.
[0194] Step S614: It is judged whether it is X=Xmax. Here, Xmax is the maximum of the X coordinate in the bit map data of an alphabetic character. If the judgment in step S614 is "Yes", processing will progress to step S615. If the judgment in step S614 is "No", processing will return to step S610.
[0195] Step S615: Only 1 makes a coordinate value Y increase.
[0196] Step S616: It is judged whether it is Y=Ymax. Here, Ymax is the maximum of the Y coordinate in the bit map data of an alphabetic character. Processing will be ended if the judgment in step S616 is "Yes." If the judgment in step S614 is "No", processing will return to step S609.
[0197] Drawing 33 shows the example of partial correction data 5e of an alphabetic character "**." The alphabetic character number 3301 expresses that the character code of an alphabetic character "**" is "4327." The number 3302 of the bit for correction expresses that the number of the bit for correction is "1" among the bits of the bit map data showing the configuration of an alphabetic character "**." It means that X coordinate 3304 and Y coordinate 3305 have a bit for correction in a location (4 2) in bit map data. This bit for correction is equivalent to the bit 3275 shown in drawing 27 A. The basic partial pattern 3306 means that central subpixel should be defined as a basic part among three subpixel arranged to horizontally (the direction of X) it contained in the pixel, when the bit for correction is matched with one pixel.
[0198] Drawing 34 shows the basic part defined by performing step S3801 of the procedure shown in drawing 28 – step S3860 to partial correction data 5e shown in the bit map data 3231 and drawing 33 which are shown in drawing 27 A. The upper bed section of a stroke of the 3rd of the alphabetic character "**" shown in the part 3342 of drawing 34 is located in a line in the shape of same straight line as other parts of the 3rd stroke. This is because the central pixel 3344 is defined as a basic part among the subpixel 3343–3345 contained in the pixel 3346 (drawing 34) corresponding to the bit 3275 for correction shown in drawing 27 A.
[0199] It is more desirable than defining a basic part as shown in drawing 27 B from a viewpoint of the grace of an alphabetic character to define a basic part, as shown in drawing 34 .
[0200] As shown in drawing 34 , after a basic part is defined, step S8 of the procedure shown in drawing 28 – step S11 are performed. Thereby, it becomes possible to display an alphabetic character "**" on high definition (in namely, desirable configuration).
[0201] Assignment of the bit for correction in partial correction data 5e and assignment of how to define the basic part about the bit for correction are beforehand performed about each of the bit map data of an alphabetic character in consideration of the grace of the alphabetic character displayed by character display device 1b. According to the basic partial definition rule explained with reference to drawing 13 A, drawing 13 B – drawing 16 A, and drawing 16 B, the bit for correction should be specified only about the part displayed in the configuration which is not desirable. Although the amount of data required in order to originate in having partial correction data 5e and to display an alphabetic character increases, there is

little the augend. Therefore, according to character display device 1b of the gestalt 2 of operation of this invention, a character display device with little high definition and amount of data required in order to be able to display on high definition and to display an alphabetic character is realized in the alphabetic character with which it is expressed by bit map data.

[0202] Thus, character display device 1b (drawing 8 B) of the gestalt 2 of operation of this invention controls the subpixel contained in the pixel (namely, group of subpixel) with which the bit was matched about the bit which is not a bit for correction based on the information on the surrounding bit of the bit in step S6 shown in drawing 28 and step S8 - step S11 (processing (1)). Moreover, character display device 1b controls the subpixel contained in the pixel with which the bit was matched about the bit for correction based on the basic partial pattern 3306 of partial correction data 5e in step S3860 shown in drawing 28 - step S11 (processing (2)). Thereby, an alphabetic character is displayed on highly minute and high definition by the display device 3.

[0203] It is dependent on partial correction data whether character display device 1b defines a basic part about each of the bit of bit map data based on the information on the surrounding bit of the bit or a basic part is defined based on the basic partial pattern specified with partial correction data. Therefore, partial correction data are assigned about each of the bit of bit map data, and can be interpreted as additional information which shows how a basic part is defined about the bit. namely, in the bit which is not specified as partial correction data as a bit for correction In the bit which the additional information which shows what "a basic part is defined for based on the information on the surrounding bit of the bit" is assigned, and is specified as partial correction data as a bit for correction It can be interpreted as the additional information which shows what "a basic part is defined for based on a basic partial pattern", and specifies a ** machine headquarters part pattern being assigned. Thus, character display device 1b changes whether it processes (1) or processing (2) is performed based on the additional information assigned to each of the bit of bit map data.

[0204] In addition, the whole alphabetic character does not need to be displayed based on the display principle explained with the gestalt 2 of operation of this invention. At least a part is displayed among alphabetic characters based on the display principle explained with the gestalt 2 of operation of this invention, and other parts can display at least the part on highly minute and high definition, when displayed by the conventional technique of arbitration. Therefore, the additional information mentioned above should just be assigned to at least one of the bit map data showing the configuration of an alphabetic character.

[0205] The bit for correction contained in the bit map data showing the configuration of an alphabetic character may have the value "1", and may have the value "0." It is not concerned with whether the value of the bit for correction is "1", or it is "0" which subpixel is defined as subpixel of a basic part among the subpixel contained in the pixel corresponding to the bit for correction, but it is dependent only on the basic partial pattern of the bit for correction. Therefore, when all the bits contained in the bit map data showing the configuration of an alphabetic character are bits for correction (i.e., when it has the DS partial correction data are indicated to be to drawing 31 R> 1), the basic part of an alphabetic character is defined only based on partial correction data, without being dependent on the bit map data showing the configuration of an alphabetic character, and an alphabetic character is displayed on high definition.

[0206] With the gestalt 3 of operation of the following this inventions, when all the bits contained in the bit map data which express the configuration of an alphabetic character in this way are bits for correction, the character display which displays an alphabetic character on high definition is explained.

[0207] (Gestalt 3 of operation) Drawing 8 C shows the configuration of character display 1c of the gestalt 3 of operation of this invention. In drawing 8 C, the same reference number is given to the same component as the component shown in drawing 8 B, and the explanation is omitted.

[0208] Character display 1c may be a personal computer. As a personal computer, the computer of the type of arbitration, such as a desktop mold or a laptop type, may be used. Or character display 1c may

be a word processor.
[0209] Furthermore, character display device 1c may be the information display of arbitration, such as electronic equipment and information machines and equipment, equipped with the display device in which color display is possible. For example, character display device 1b may be electronic equipment equipped with the electrochromatic display display device, the Personal Digital Assistant which is a pocket information tool, a portable telephone containing PHS, communication equipment, such as general telephone/FAX, etc.
[0210] Character display device 1c does not have bit map data 5a shown in drawing 8 B. Moreover, character display device 1c is changed to partial correction data 5e shown in drawing 8 B, and has basic partial data 5f.
[0211] Basic partial data 5f stored in the auxiliary storage unit 40, it has the same DS as partial correction data 5e shown in drawing 31 . The basic part of an alphabetic character is defined about all the bits of the bit map data showing the configuration of an alphabetic character with the basic partial pattern 3306 by partial correction data 5e shown in drawing 31 . This basic part is expressed as (0, 1, 0), and each of these elements "0", "1", and "0" corresponds to one subpixel. As mentioned above, an element "1" is the subpixel of a basic part. Thus, the basic part of an alphabetic character is defined per subpixel basic partial data 5f.
[0212] The procedure of display-program 41c is the same as the procedure of display-program 41b except for step S602 of the procedure shown in step S3803 - step S3805, and drawing 32 of the procedure shown in drawing 28 R> 8, step S603 and step S604 - step S607 being skipped.
[0213] In addition, basic partial data 5f DS may be the DS of the arbitration which is not limited to the same DS as partial correction data 5e shown in drawing 31 , but defines the basic part of an alphabetic character per subpixel. For example, it is not necessary to have the basic partial pattern which defines a basic part for every bit for correction (every [namely,] pixel) basic partial data 5f. Basic partial data 5f, you may have the basic partial pattern which defines a basic part about the whole alphabetic character. In such a case, it changes to processing of step S611 and step S612 which are shown in drawing 32 R> 2, and processing which matches with the subpixel of a display device directly each element of the basic part by which the whole alphabetic character is defined may be performed.
[0214] Basic partial data 5f, you may have the DS which reduced the amount of data according to the compression method of arbitration, such as a run length compression method. When the character size of an alphabetic character especially expressed by basic partial data 5f is large, the effectiveness of reducing the amount of data according to a compression method becomes large.
[0215] As mentioned above, the control section 20 of character display 1c reads basic partial data 5f from an auxiliary storage unit 40 (storing section) in step 610 shown in drawing 32 .
[0216] Moreover, the control section 20 of character display 1c sets the color element level of at least one specific subpixel corresponding to the basic part of an alphabetic character as predetermined color element level (for example, the greatest color element level) in step 8 shown in drawing 10 .
[0217] Furthermore, the control section 20 of 1d of character display sets the color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of an alphabetic character in step 9 shown in drawing 10 as color element level other than predetermined color element level (for example, color element level other than the greatest color element level).
[0218] Thus, an alphabetic character does not have a color noise in a display device 3, and is displayed on highly minute and high definition.
[0219] (Gestalt 4 of operation) Drawing 8 D shows the configuration of 1d of graphic displays of the gestalt 4 of operation of this invention. The same reference number is given to the same component as the component shown in drawing 8 A among the components shown in drawing 8 D, and explanation is omitted.
[0220] 1d of graphic displays may be the information display of arbitration, such as electronic equipment and information machines and equipment, equipped with the display device in which color display is

possible.
[0221] Display-program A 91a is a program for displaying the graphic form expressed by the binary bit map data 5a or 25a on a display device 3 with the conventional technique displayed by the pixel measure. Display-program B 6a is a program used when displaying the graphic form expressed by the binary bit map data 5a or 25a on a display device 3 with the graphic form method of presentation of this invention. Display-program B The procedure with which 6a displays a graphic form is the same as the procedure explained with reference to drawing 10 .
[0222] Or display-program B The procedure with which 6a displays a graphic form may be the same as the procedure explained with reference to drawing 28 . In that case, 1d of graphic displays may have basic partial data 5f shown in partial correction data 5e or drawing 8 C shown in drawing 8 B.
[0223] Display device property data 5d is data showing the input-output behavioral characteristics of a display device 3, for example, is the table or function expression showing the relation between the input intensity level for every color element, and an output brightness value.
[0224] Brightness table generator 6b generates the brightness table which fitted the display device 3 according to predetermined procedure, having the property data (it being called a criteria display device property) of the display device used as criteria, and a brightness table (criteria brightness table) used as the criteria corresponding to it in the interior, and referring to display device property data 5d.
[0225] Actuation of brightness table generator 6b is explained below.
[0226] Drawing 35 shows the relation between a criteria display device property and the property of a display device 3. A curve 261 shows a criteria display device property, and a curve 262 shows the property (display device property data 5d) of a display device 3. An input level (axis of abscissa) is an intensity level of subpixel, and a normalization output level (axis of ordinate) is the value which normalized the actual brightness value of the subpixel for example, on a display device. Curves 261 and 262 are a criteria display device property in a certain specific color element, and the property of a display device 3, respectively. The relation between such a criteria display device property and the property of a display device 3 is obtained by each color element (R, G, B) of every. As shown in curves 261 and 262, the property of a display device 3 is not necessarily in agreement with a criteria display device property. For example, although an input level required in order to obtain the desired normalization output level M3 with the display device used as criteria is L3, an input level required in order to obtain M3 with a display device 3 is L3+d3. difference [in / for a value d3 / an input level L3] -- it is called a value. difference [in / respectively / in the values d1-d6 shown in drawing 35 / an input level L1 - L6] -- it is a value. in addition, difference [in / when shown in drawing 35 / input levels L0 and L7] -- a value is 0. a curve 267 -- an input level and difference -- relation with a value is shown. the difference shown in a curve 267 for every color element supposing input levels L0-L7 are intensity levels corresponding to the color element level 0-7 in a criteria brightness table, respectively -- the amount of corrections of a criteria brightness table is obtained from a value. namely, the intensity level L3 corresponding to [at the above-mentioned example] the color element level 3 with a criteria brightness table -- difference -- only a value d3 is corrected and the intensity level corresponding to the color element level 3 is set to L3+d3 on the brightness table after correction.
[0227] Drawing 36 shows the amount of corrections of a criteria brightness table. the difference which the value shown in a table 2792 is the amount of corrections of an intensity level, and is shown with a curve 267 (drawing 35) in each color element (R, G, B) of every -- it is a value. however, the difference of the intensity level corresponding to the adjoining color element level which is defined as a criteria brightness table -- the above -- difference -- when a value is large, the amount of corrections of an intensity level may be made to be restricted to the difference of the above-mentioned intensity level. For example, since the difference of the intensity level (36) to the color element R defined as the brightness table 92 and the color element level 6 and the intensity level (73) to the color element R and the color element level 5 is 37 when the brightness table 92 shown in drawing 5 as a criteria brightness table is used, the upper limit of the amount of corrections of the intensity level to the color element R

and the color element level 6 is restricted to 37. The amount of corrections of an intensity level can be made into the value which suited the criteria brightness table by such limit. In addition, it is instantiation-like [the amount of corrections shown in a table 2792], and the amount of corrections may change according to the property of a display device 3.

[0228] Drawing 37 shows the correction brightness table 2892 obtained by correcting a criteria brightness table. The correction brightness table 2892 is obtained by applying the amount of corrections shown in a table 2792 (drawing 36 R> 6) to the intensity level defined as the brightness table 92 using the brightness table 92 shown in drawing 5 R> 5 as a criteria brightness table.

[0229] Such a correction brightness table is display-program B. In case 6a changes color element level into an intensity level, it is used in step S10 of the procedure shown in drawing 10 .

[0230] Drawing 38 shows the procedure of brightness table generator 6b. Brightness table generator 6b is performed by CPU2. Moreover, brightness table generator 6b exchanges a display device 3, and when the display device property data 5d content is changed according to it, it is performed. Hereafter, the procedure of brightness table generator 6b is explained for every step.

[0231] Step SB 1: The display device property data 5d content is read into main memory 4.

[0232] difference [in / the display device property read at the Step SB2:step SB 1 is compared with a criteria display device property, and / each intensity level] -- a value is calculated. Each intensity level is an intensity level defined to each color element and each color element level in a criteria brightness table here. In addition, the comparison with the display device property and criteria display device property which were read at a step SB 1 is performed about each color element (R, G, B). The criteria display device property and the criteria brightness table are built into the interior of brightness table generator 6b.

[0233] the difference called for at the Step SB3:step SB 2 -- based on a value, the amount of corrections is calculated so that a criteria brightness table may be suited.

[0234] Step SB 4: A correction brightness table is generated by applying to a criteria brightness table the amount of corrections calculated at a step SB 3.

[0235] In addition, a criteria display device property and the property of a display device 3 are not limited to being expressed with the transcription of the color elements R, G, and B. For example, it may be expressed with the transcription of the color elements C (cyanogen), Y (yellow), and M (MAZENDA). Thus, the property data expressed by other transcriptions can be changed into the transcription of the color elements R, G, and B using a predetermined function expression.

[0236] When displaying contents data, such as a digital book, by 1d of graphic displays, it is display-program A. 91a may also include the fundamental function for displaying a graphic form on a display device 3, and also reading digital books, such as page alignment of a digital book, page turning over, and a bookmark. Display-program A 91a is display-program B, in case a graphic form is displayed. It investigates whether 6a exists. Display-program B When 6a exists, said fundamental function is display-program A. The function which is realized by 91a and displays a graphic form on a display device 3 is display-program B. 6a realizes. Display-program B The function which displays said fundamental function and fundamental graphic form when 6a does not exist is display-program A. 91a is realized. In this case, a graphic form is displayed by the conventional technique displayed by the pixel measure. Such control is performed by the control section 20.

[0237] When 1d of graphic displays is constituted as mentioned above, it is display-program B. 6a, brightness table generator 6b, and amendment pattern table 5b may not be stored in an auxiliary storage unit 40, but may be supplied from the outside. In this case, 1d of graphic displays is display-program A in an auxiliary storage unit 40. It has only 91a, bit map data 5a, and display device property data 5d, and if 1d of graphic displays is independent, they have only the function which displays a graphic form with said fundamental function and the conventional technique. Display-program B 6a, brightness table generator 6b, and amendment pattern table 5b are the formats of an applet, for example, if supplied as some contents data of a digital book, when an applet functions as a program and data in 1d of graphic

displays, the high definition presentation graphic feature by this invention will be realized.
[0238] It becomes possible to apply the graphic-display technique of this invention to the personal computer used conventionally or a Personal Digital Assistant by supply in such an applet format. It is judged by the control section 20 whether the applet is contained as some contents data. Thereby, in 1d of graphic displays, it adds to said fundamental function, and the function which displays a digital book in a high definition alphabetic character is realized. The digital book displayed in the high definition alphabetic character has the effectiveness which mitigates fatigue of a reader's eye. When reading a digital book with the information display of a pocket mold with especially the constraint to a screen size, especially a high definition alphabetic character is desirable.
[0239] In addition, contents data, such as a digital book containing these applets, may be offered by record medium like CD-ROM or a memory card, may be inputted into 1d of graphic displays through the read-out equipment (input device 7) of a record medium, and may be inputted into 1d of graphic displays via a network communication way. Network communication ways may be the telephone line and a radiocommunication circuit. Furthermore, an applet is not as some contents data and it may be independently inputted into 1d of graphic displays.
[0240]
[Effect of the Invention] According to this invention, the subpixel contained in a group in each bit of the bit map data showing a graphic form based on the information on the surrounding bit of the bit matched with one of matching and the groups by one of the groups who consist of two or more subpixel of the number of arbitration is controlled independently gradually. Although the resolution which bit map data have is equivalent to a group's size, the resolution as which a graphic form is displayed is equivalent to the size of subpixel. Therefore, a graphic form can be displayed with high definition in resolution higher than the resolution which the bit map data of a graphic form have. Moreover, the structure of bit map data is bit map data binary [the / as the dot font used conventionally / same], and there is little amount of data required in order to display a graphic form, and it ends.
[0241] Moreover, according to this invention, it responds to the additional information assigned to at least one of each of the bit of the bit map data showing an alphabetic character. (1) It is based on the information which is the bit of the circumference which is the bit to which said additional information was assigned. [whether the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled, and] (2) It is changed whether based on the pattern specified by said additional information, the subpixel contained in the group with whom the bit to which said additional information was assigned was matched is controlled. About the part displayed in the configuration which is not desirable when subpixel is controlled among alphabetic characters based on the information on a surrounding bit, subpixel is controlled based on the pattern specified by additional information. Thereby, there is little high definition and amount of data required in order to be able to display on high definition and to display an alphabetic character, and it ends the alphabetic character with which it is expressed by bit map data.
[0242] Moreover, according to this invention, based on said basic partial data, the color element level of at least one specific subpixel corresponding to the basic part of said alphabetic character is set as predetermined color element level. The color element level of at least one subpixel which adjoins at least one specific subpixel corresponding to the basic part of said alphabetic character is set as color element level other than said predetermined color element level. Since each strength of two or more color elements is gradually expressed by two or more color element level, it can change the color element level between adjoining subpixel gradually. Thereby, it can control that a color noise occurs. Since basic partial data define the basic part of an alphabetic character per subpixel, they can display an alphabetic character on highly minute and high definition.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the screen 400 of the usable display device 3 in the graphic display of this invention typically.
[Drawing 2] It is drawing showing the example which displayed the slash on the 6 pixel x12 pixel screen 400 of a display device 3.
[Drawing 3] It is drawing showing the example which displayed the slash on the screen 400 of a display device 3 more thinly than the slash shown in drawing 2 .
[Drawing 4] It is drawing showing the example which displayed the slash on the screen 400 of a display device 3 more thickly than the slash shown in drawing 2 .
[Drawing 5] It is drawing showing the brightness table 92 which defines the relation between the color element level (level 7 – level 0) of subpixel, and the intensity level of subpixel.
[Drawing 6] It is drawing showing the brightness table 94 which defines the relation between the color element level (level 7 – level 0) of subpixel, and the intensity level of subpixel.
[Drawing 7] It is drawing showing the brightness table 96 which defines the relation between the color element level (level 7 – level 0) of subpixel, and the intensity level of subpixel.
[Drawing 8 A] It is the block diagram showing the configuration of graphic-display 1a of the gestalt 1 of operation of this invention.
[Drawing 8 B] It is the block diagram showing the configuration of character display device 1b of the gestalt 2 of operation of this invention.
[Drawing 8 C] It is the block diagram showing the configuration of character display device 1c of the gestalt 3 of operation of this invention.
[Drawing 8 D] It is drawing showing the configuration of 1d of graphic displays of the gestalt 4 of operation of this invention.
[Drawing 9] It is drawing showing the amendment pattern table 2060 as an example of amendment pattern table 5b stored in an auxiliary storage unit 40.
[Drawing 10] It is the flow chart which shows the procedure of display-program 41a.
[Drawing 11] It is drawing showing some bit map data showing a graphic form.
[Drawing 12] It is drawing showing a part of screen of a display device 3.
[Drawing 13 A] It is drawing showing about eight example of the bit D (x y) currently observed in bit map data.
[Drawing 13 B] When it has the value about eight bit of Bit D (x y) is indicated to be to drawing 13 A, it is drawing showing the subpixel defined by the basic partial definition rule.
[Drawing 14 A] It is drawing showing other about eight examples of the bit D (x y) currently observed in bit map data.
[Drawing 14 B] When it has the value about eight bit of Bit D (x y) is indicated to be to drawing 14 A, it is drawing showing the subpixel defined by the basic partial definition rule.
[Drawing 15 A] It is drawing showing about eight example of further others of the bit D (x y) currently observed in bit map data.
[Drawing 15 B] When it has the value about eight bit of Bit D (x y) is indicated to be to drawing 15 A, it

is drawing showing the subpixel defined by the basic partial definition rule.
[Drawing 16 A] It is drawing showing about eight example of further others of the bit D (x y) currently observed in bit map data.
[Drawing 16 B] When it has the value about eight bit of Bit D (x y) is indicated to be to drawing 16 A, it is drawing showing the subpixel defined by the basic partial definition rule.
[Drawing 17] It is drawing showing all "1" of about eight dot, or the combination of "0."
[Drawing 18] It is drawing showing the result of having applied the basic partial definition rule, to the conventional dot font shown in drawing 39 B.
[Drawing 19] It is drawing showing the example which set the color element level of the subpixel defined as a basic part shown in drawing 18 as level 7, and set up the color element level of the subpixel near the subpixel defined as a basic part using the amendment pattern table 2060.
[Drawing 20] It is drawing showing the amendment pattern table 2170 as a modification of amendment pattern table 5b.
[Drawing 21] It is drawing showing the amendment pattern table 2180 as a modification of amendment pattern table 5b.
[Drawing 22] It is drawing showing the amendment pattern table 2270 as a modification of amendment pattern table 5b.
[Drawing 23 A] It is drawing in which showing the bit which has the value of "1" among the bit map data of the graphic form showing the segment of tantheta=1 with the rectangle which performed hatching, and showing the bit which has the value of "0" with the rectangle of void.
[Drawing 23 B] It is drawing showing the subpixel defined as a basic part of the graphic form showing the segment of tantheta=1.
[Drawing 23 C] It is drawing showing the example which set up the color element level of the subpixel near the subpixel defined as a basic part of the graphic form showing the segment of tantheta=1.
[Drawing 24 A] It is drawing in which showing the bit which has the value of "1" among the bit map data of the graphic form showing the segment of tantheta=1/3 with the rectangle which performed hatching, and showing the bit which has the value of "0" with the rectangle of void.
[Drawing 24 B] It is drawing showing the subpixel defined as a basic part of the graphic form showing the segment of tantheta=1/3.
[Drawing 24 C] It is drawing showing the example which set up the color element level of the subpixel near the subpixel defined as a basic part of the graphic form showing the segment of tantheta=1/3.
[Drawing 25 A] It is drawing in which showing the bit which has the value of "1" among the bit map data of the graphic form showing the segment of tantheta=2 with the rectangle which performed hatching, and showing the bit which has the value of "0" with the rectangle of void.
[Drawing 25 B] It is drawing showing the subpixel defined as a basic part of the graphic form showing the segment of tantheta=2.
[Drawing 25 C] It is drawing showing the example which set up the color element level of the subpixel near the subpixel defined as a basic part of the graphic form showing the segment of tantheta=2.
[Drawing 26 A] It is drawing in which showing the bit which has the value of "1" among the bit map data of the graphic form showing the segment of tantheta=4 with the rectangle which performed hatching, and showing the bit which has the value of "0" with the rectangle of void.
[Drawing 26 B] It is drawing showing the subpixel defined as a basic part of the graphic form showing the segment of tantheta=4.
[Drawing 26 C] It is drawing showing the example which set up the color element level of the subpixel near the subpixel defined as a basic part of the graphic form showing the segment of tantheta=4.
[Drawing 27 A] It is drawing showing the bit map data 3231 (dot font) showing the configuration of the alphabetic character "**" of the kanji of having a 11 dot x11 dot character size.
[Drawing 27 B] It is drawing showing the result of having applied the basic partial definition rule, to the bit map data 3231.

[Drawing 28] It is the flow chart which shows the procedure of display-program 41b.
[Drawing 29] It is drawing showing the DS of partial correction data 5e in case the number N of the bit for correction is under Nmax more greatly than 0.
[Drawing 30] It is drawing showing the DS of partial correction data 5e when the number N of the bit for correction is equal to 0.
[Drawing 31] It is drawing showing the DS of partial correction data 5e when the number N of the bit for correction is equal to Nmax.
[Drawing 32] It is the flow chart which shows the detailed procedure of processing of defining the subpixel of a basic part based on partial correction data 5e.
[Drawing 33] It is drawing showing the example of partial correction data 5e of an alphabetic character "**."
[Drawing 34] It is drawing showing the basic part defined by performing step S3801 of the procedure shown in drawing 28 - step S3860 to partial correction data 5e shown in the bit map data 3231 and drawing 33 which are shown in drawing 27 A.
[Drawing 35] It is drawing showing the relation between a criteria display device property and the property of a display device 3.
[Drawing 36] It is drawing showing the amount of corrections of a criteria brightness table.
[Drawing 37] It is drawing showing the correction brightness table 2892 obtained by correcting a criteria brightness table.
[Drawing 38] It is the flow chart which shows the procedure of brightness table generator 6b.
[Drawing 39 A] It is drawing showing the example which displayed the alphabetic character of "A" of the alphabet on the 5 pixel x9 pixel screen 900 with the technique which displays the bit map data corresponding to the conventional monochrome binary one on a pixel measure.
[Drawing 39 B] It is drawing showing the bit map data 904 of "A" of the alphabet displayed on the screen 900.
[Drawing 40 A] It is drawing showing the example which displayed "A" of the alphabet on the screen 910 of a electrochromatic display with the amelioration technique of the technique which displays the conventional bit map data on a pixel measure.
[Drawing 40 B] It is drawing showing the bit map data 916 based on the amelioration conventional technique.
[Description of Notations]
1a, 1d Graphic display
1b, 1c Character display
2 CPU
3 Display Device
4 Main Memory
5 Data
5a, 25a Bit map data
5b Amendment pattern table
5c Brightness table
5d Display device property data
5e Partial correction data
5f Basic partial data
6a, 41a, 41b, 41c, 91a Display program
91a Display-program A
6a Display-program B
6b Brightness table generator
7 Input Device
12 Pixel

14R, 14G, 14B Subpixel
20 Control Section
26 Text Data

[Translation done.]